Telephone Engineer

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Transmitter Merged with Telephone Engineer

With this issue Transmitter & Electrical Journal, of Fort Worth, Texas, is merged with TELEPHONE ENGINEER.

The passing of Transmitter & Electrical Journal removes from the telephone industry one of its old and familiar landmarks. Founded in 1905 by the Smiths, Aaron and J. A., it has carried on for more than a quarter of a century. In fact, it was the only regional publication in this largest of utility industries to survive the hardships of the inevitable series of business panics, depressions, and readjustments over so long a period.

Later the publication was handed down to the son of J. A. Smith, Ray W. Smith, who for the last three years has had complete charge, and has retained the high standards of the former owners.

Some ten years ago Transmitter absorbed the Southwestern Public Service Journal of Oklahoma City and thus increased its activities to cover other public utilities in addition to the telephone industry, which has brought it in closer contact with the power, light and gas interests of Texas and Oklahoma, as well as the larger oil and pipe line companies.

Since its advent into the field in 1905, Transmitter has been the official organ of the Texas Independent Telephone Association, and for many years the official organ of the Oklahoma Utilities Association, the Southwestern Public Service Association and other organizations in the Southwest.

Although it is with sincere regret that we permit Transmitter & Electrical Journal to lose its identity, TELEPHONE ENGINEER'S entire staff will strive to interest the former readers of Transmitter sufficiently to cause them to continue to subscribe and read TELEPHONE ENGINEER year after year.

In addition, we feel that the regular readers of TELEPHONE ENGINEER will find this publication of more intrinsic interest and value to them than ever before.

This Telephone Man Understands How to Give

There is a telephone man who has built a garden spot in the almost dry middle-west. A quarter of a century ago C. L. Brown was an employe of a telephone company in Wichita, Kans. He had vision. He brought his young family to Abilene, Kans., where he succeeded in interesting the citizens in a civic telephone exchange. The telephone company prospered. He added a light company, and a gas and water company. They prospered. He annexed other telephone exchanges throughout the state. Finally he went out of the state, into Nebraska, Missouri, Illinois, Indiana and Pennsylvania.

Everybody in Kansas knows and loves C. L. Brown, who heads the United Companies, of which the United Telephone Company has always been his first interest. But it is not of his phenomenal success of which we wish to speak here. It is too well known. It is of the man himself we wish to tell you—a man who some twenty years ago gained the confidence of his friends and neighbors to the extent of investing their savings in his infant telephone company—and who since that time has returned a large proportion of his private fortune to the community which gave him his original backing.

Every church, every charity, and every civic organization in Abilene knows it can expect C. L. Brown to head the list of contributors whenever a drive is made for funds. An important department in his organization is the welfare department. But Mr. Brown does not let his civic interest pause there.

Three years ago he started construction of the Brown Memorial Park, a few miles beyond the city limits of Abilene, named in honor of his parents. First he built a lake, which like a lagoon winds about through the park. Later he equipped the lake with diving towers, bath houses, row boats, motor boats. At either end of the park is a camp, with cottages, out-door ovens, and a supervisor. One camp is for girls, and another for boys. Any group may use one of the camps free for an entire week, merely by making reservations ahead of time. There

are also tennis courts and two golf courses in the process of construction. Right here it might be said there is absolutely no charge for using the park or for using anything in the park.

As Mr. Brown himself said in welcoming delegates to the recent Kansas Telephone Association convention held in Abilene, who were his guests at a barbecue in the woods of the park, "It's all yours. Go to it!"

But the park is not the greatest of Mr. Brown's works. On a hill overlooking the Brown Memorial Park is an imposing colonial house, the Brown Memorial Home for the Aged. This beautiful structure has just been completed and furnished. It was our privilege to be shown through it during the recent convention. The word "home" really should not be applied to it. Unlike the usual "home for aged" it possesses every modern comfort and convenience and many of the luxuries. The rooms are colorful and each is furnished and decorated individually. There is a sumptuous drawing room, wide verandas, cozy lounges where deep chairs invite laziness and radios provide entertainment. Halls are richly carpeted and excellent paintings adorn the walls.

The home is for elderly people of both sexes who need a pleasant place to spend the twilight years of life. The residents are selected from worthy applicants who reside in the territory served by the United Companies.

Within the city limits of Abilene, are two other "homes" decorated and furnished along similar lines. One is the home for orphans, and the other is the home for working girls.

We read of extensive philanthropy from other wealthy men, which perhaps in some instances, exceeds that of Mr. Brown. But rarely do we hear of anyone who gives so freely, so generously, and so whole-heartedly as does Mr. Brown, or who plans toward the happiness of his fellow-citizens, providing them with recreation and pleasant living facilities with so few "strings" attached to them.

It is our belief that it takes a telephone man whose every day business activities require an understanding and tolerance of other persons, to really understand the art of giving. Many men give money which perhaps "does good" but brings little happiness. Mr. Brown gives happiness with every cent of the vast sums he gives or invests for the benefit of other people.

VACUUM TUBE THEORY AND PRACTICE

SUBJECT: SHORT WAVE RADIO TELEPHONY AND TELEGRAPHY

General

When the radio first began to catch the public's fancy there were some who prophesied that it would soon supplant the telephone and that wires between central office and subscribers' stations would no longer be needed.

To those familiar with the basic theory of the radio, it was obvious from the start that the radio principle would never displace local telephone systems as we now know them.

Kilocycles		*Meters*		
400,000	to 401,000	0.7496	to	0.7477
56,000	to 60,000	5.00	to	5.36
28,000	to 30,000	10.00	to	10.71
14,000	to 14,400	20.83	to	21.43
7,000	to 7,300	41.1	to	42.9
3,500	to 4,000	75.0	to	85.7
1,715	to 2,000	150.0	to	175.0

Fig. 1—Wave bands assigned to amateur use.

Had the original prophet predicted that the radio would supplement the wire telephone system, he would have scored a bull's eye.

Our international radio telephone channels, ship to shore telephony, aviation radio channels, our high frequency carrier systems, and the announcement some time ago of radio communication channels between principal cities in the U. S., all very aptly illustrate the fact that the radio has supplemented the telephone. All of which brings up the question, "Should the average telephone man be concerned with what's going on in this tie-up between the radio and the telephone?"

Fig. 2—National short wave receiver

For those who wish to keep abreast of the times, and at the same time improve their technical knowledge of this relatively new art, the answer is that the average telephone man *should* be interested. The telephone man who is located in a small town some distance away from a large metropolitan center may feel that he has no chance to keep posted on the new developments in radio communication channels. This is not true and on the contrary he is in some respects better situated to find out what's going on than the man who is in the thick of constant activity.

The purpose of this article is to discuss ways and means for telephone men to acquire a hobby which never grows old and one which will result in a wealth of technical instruction on this new art which is supplementary to the telephone. The vacuum tube may some day be as common in a telephone office as relays are now. The far-seeing telephone man should learn all he can about tubes and their uses.

Amateur Short Wave Radio

There are a number of ways in which a good working knowledge of vacuum tubes and their uses in radio communication channels can be obtained. Extensive reading of radio and telephone publications bearing on this subject will be helpful.

Another method which combines both pleasure and instruction on the radio communication art is "amateur short wave radio."

The Government defines an "amateur" as a person interested in radio technique solely with a personal aim and without pecuniary interest. There are at the present time more than 15,000 amateurs in this country. Engineers, lawyers, high-school boys, college students and persons

in all walks of life constitute this group whose communication system is world-wide. Hundreds of messages fly back and forth across the country at all hours of the day and night, originated by this cosmopolitan group.

Recognizing the good accomplished by amateur radio in the way of radio art development, emergency communications during public disaster, good will created by international contact, etc., the Government for a number of years has granted licenses to United States citizens to operate short wave transmitting sta-

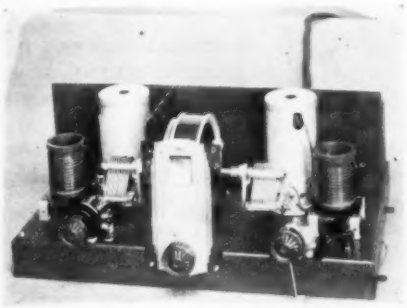

Fig. 3—Interior view of National short wave receiver.

tions on certain assigned short wave bands. Many foreign countries grant similar privileges. Figure 1 shows the short wave bands which are assigned to amateur use.

These licenses are obtainable without cost but require that the applicant answer certain questions pertaining to short wave transmitting sets and to the radio laws, and that he be able to send and receive at least ten words per minute in continental telegraph code.

This examination for a license to operate and own a short wave amateur station can be taken by mail.

A few weeks' study and thirty days' consistent code practice will put anyone in shape to get a license. Once the license is obtained a small short wave transmitter can be built and put "on the air."

Strange as it may seem, a low powered short wave transmitter is less costly than a good short wave receiver. Low power does not mean that the set will be suitable for communication only for short distances; on the contrary, the short waves enable communication over exceptionally long distances with small power. During "low power" tests held several winters ago an amateur in Ohio carried on a two-way telegraph communication with an amateur in Australia and the Ohio amateur used the smallest radio receiving tube (the 199 type) with less than 90 volts B battery for his transmitting tube and plate power. With only a fraction of a watt of power he threw understandable signals half way around the world! While this is an extreme case it aptly illustrates the point.

This should not be interpreted to mean that a 199 type tube and a B battery are all that is needed for a short wave radio transmitter, but rather to stress the fact that nationwide communication can be consistently carried on with nothing larger than the ordinary 210 type tube with several hundred volts as the power supply.

The transmitting phase of amateur radio may not appeal to some who are nevertheless interested in radio communication. In such cases a good short wave receiver and a little daily practice trying to copy short wave telegraph stations which will be heard from all parts of the world will soon enable one to follow developments and derive a great deal of enjoyment from merely "listening in."

Proposed Telephone Group of Amateurs

It has been suggested to the writer that telephone men in all parts of this country and Canada who are interested in short wave transmitting and receiving, organize into a group for the purpose of making contact with each other via the "short waves" for the purpose of carrying on tests and conversing on matters of mutual interest.

Such a plan has met with the enthusiastic endorsement of a number to whom it has been suggested and who desire to get the names of everyone interested in joining such a group. Anyone interested in becoming affiliated with such a group are requested to write B. C. Burden, transmission engineer, Lincoln Telephone & Telegraph company, Lincoln, Nebraska, who will supply details of the plan as well as technical data on standard transmitting and receiving circuits. Complete information describing how a license may be obtained is also covered in the notes which Mr. Burden has available.

Ten cents in stamps should be included to cover the mailing costs.

If a sufficiently large number of persons respond it is planned to issue a monthly bulletin to the group describing the stations of the different members, tests, and other information of general interest.

It is hoped that a group of several hundred can be obtained, and once established many friendships will result from the two-way radio telegraph and telephone communications which can be carried on, as well as giving the participants an excellent grounding in radio communication theory.

In order to acquaint the readers of this department with some of the features of short wave receiving and transmitting, suitable equipment will be described in this and in next month's article.

Short Wave Receivers

The real thrill of radio is never known until one has listened over a good short wave set.

Short wave broadcasting stations are located in England, Holland, Germany, Australia and many other foreign countries. These stations operate on regular schedules and under favorable conditions can be heard regularly in the United States. Army and navy telephone and telegraph stations are constantly on the air. Day and night transport planes can be heard talking to the ground stations. Hundreds of amateurs in this and other countries can be heard throughout the day and night visiting back and forth by telephone and telegraph.

The satisfactory reception of short wave telegraph and telephone signals requires a receiver of good design. While there are literally hundreds of different makes of commercial broadcast receivers, there are only a few short wave receivers being offered to the public.

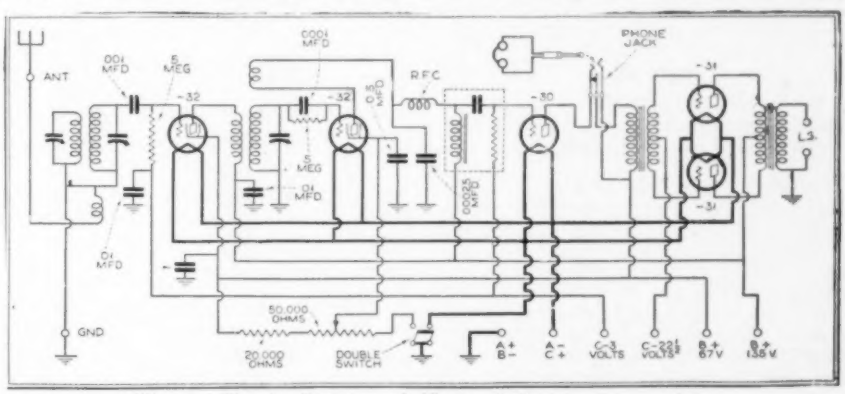

Fig. 4—Circuit diagram of National short wave receiver.

Great care must be exercised in the selection of a short wave receiver, otherwise a receiver may be obtained which does not completely cover all commercial short waves, or one which does not permit the reception of continuous wave telegraph stations.

The writer in connection with the proposed organization of a group of telephone amateurs investigated a number of different commercial short wave receiving sets in an endeavor to find one which would most nearly answer the requirements for an all around receiver.

A commercial receiver which seemed to best fill the bill is shown in Figure 2.

Figure 3 shows the interior of this excellent set.

This particular receiver is now being used on one of the large air transport lines and is very popular with amateurs in this and foreign countries. It is available in either AC or DC models and is very reasonably priced. By means of plug-in coils it has a wave length range of 9 to 550 meters. Its reception range is practically unlimited and with the DC model the writer has heard stations in all parts of the world.

Referring to Figure 4, which shows the circuit diagram of the DC model, it

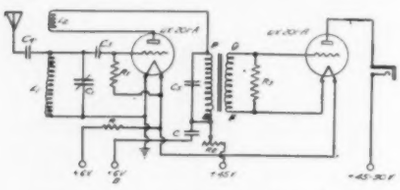

Fig. 5—Short wave receiver circuit

Parts

C —1 *ufd by-pass condenser.*
C_1—50 *uufd tuning condenser.*
C_2—100 *uufd fixed grid condenser.*
C_4—*Antenna coupling condenser, two ½" square brass plates about ⅛" apart.*
C_5—2000 *uufd fixed by-pass condenser.*
R —20 *ohm rheostat.*
R_1—8 *to* 10 *megohm.*
R_2—50,000 *ohm variable resistor.*
R_3—0.1 *megohm resistor.*

Coil Data

Both grid and tickler coils are wound with 26 gauge d. s. c. wire. The number of turns used are as follows:

Band	*Grid Turns*	*Tickler Turns*
1,715 *KC*.....	49	8
3,500 *KC*.....	33	7
7,000 *KC*.....	15	6
14,000 *KC*.....	6	5
28,000 *KC*.....	3	3

No spacing is used between turns except in the grid coil for the 28,000 KC band where the spacing is ⅛". The 1,715 KC coil should be wound on a 2" diameter.

will be noted that it consists of a stage of screen grid tuned radio frequency amplification followed by a screen grid detector and two stages of audio amplication followed by a screen grid detector and two stages of audio amplification. The last stage of audio is of the push-pull variety.

Provision is made for using head phones by means of a jack which is cut in directly after the first stage of audio.

Tuning is provided by means of a single control driving two ganged condensers. A small timing condenser is provided but once set this seldom requires changing.

By means of a variable potentiometer arranged to change the voltage on the screen grid of the detector tube a very effective control of regeneration is obtained.

Regeneration is a necessary feature in any short wave set, as it is necessary to throw the set into oscillation so that continuous wave telegraph stations can be received.

Other features of the SW-5 are the careful shielding of the radio frequency stage, special short wave noiseless condensers and convenient plug-in arrangements for the two wave changing coils.

These coils are wound on special forms composed of a material known as R-29 which has exceptionally low losses. The coils are wound in grooves cut in the forms so that they can be handled without disturbing windings.

Eight sets of coils are available for use in the SW-5 and have the following ranges and applications:

Coil No.	Wave Range	Purpose
10	9—15	International broadcasts; commercial signals; amateur 28 megacycle band.
11	14—25	International broadcasts; commercial signals; amateur 14 megacycle band.
12	23—41	International broadcasts; commercial signals.
13	38—70	International broadcasts; commercial signals; amateur 7 megacycle or 7000 k. c. band.
14	65—115	International broadcasts; amateur 3.5 megacycle or 3500 k. c. band.
15	115—200	Amateur 1.75 megacycle or 1750 k. c. band.
16	200—360	Regular broadcasts.
17	350—550	Regular broadcasts.

The battery operated model of the SW-5 is designed for operation with the new 2-volt low current tubes and can therefore be operated off of either a single storage cell or dry cells.

The A. C. model uses the regular full size A. C. tubes.

In addition to its exceptionally fine performance the SW-5 is very attractively housed in a brown metal case. For those that desire to purchase a commercial unit this set is recommended, and information concerning it may be obtained by writing the National Company, Inc., Malden, Mass.

To those who will desire to build their own short wave receiver the circuit shown in Figure 5 is recommended.

This circuit consists of a detector and two stages of audio. The coils are wound on ordinary vacuum tube bases. The tuning condensers should be special short wave condensers for best results. This circuit will work fairly good on telegraph signals but is not highly effective on telephone signals due to the lack of radio frequency amplification preceding the detector.

For those that want to get the maximum results, it is recommended that a commercial short wave receiver be purchased in preference to building one.

Another disadvantage of this type of set is the fact that stations cannot be accurately logged. Many of these tube base receivers are in use by amateurs and as mentioned they work very satisfactory for the reception of continuous wave stations. It is not necessary for an amateur to purchase a commercial transmitter, as it is possible to build an excellent transmitting layout at small cost. Such a unit will be described in next month's article. Practically all amateur stations use home built transmitting units.

Conclusion

It may appear to some readers that this month's article has but little connection with the telephone business.

While strictly true that short wave radio is not yet an extremely active partner of the telephone business, yet it is constantly becoming more so. Now is the time to get in and find out what's going on down in that vast region below 200 meters, and for those that decide to take part in the proposed short wave group a real "kick" is assured in addition to the technical information that will inevitably result.

Summer time, while usually considered an off season for radio, is an ideal time to begin to get together equipment, license, and other essentials of the transmitting amateur and by fall or sooner the proposed telephone amateur group should be well organized.

Don't fail to write B. C. Burden, care of Lincoln Telephone & Telegraph company, Lincoln, for details of the proposed organization, and for the free technical data on amateur receiving and transmitting, which he has available for those interested. Ten cents in stamps should be included with the request to cover the cost of mailing.

NEW YORK TELEPHONE CO. TO REDEEM BONDS

The Board of Directors of the New York Telephone company, at their meeting today, authorized the redemption on August 1, 1931, of the company's 6 per cent debenture bonds due February 1, 1949, which are redeemable at $110 on any semi-annual interest date. This issue of $25,000,000 was put out in 1919. Since that time the operation of the sinking fund provisions has reduced the amount outstanding in the hands of the public to $19,400,900.

Notice of redemption will be given by publication as provided in the trust indenture under which these debentures were issued.

The company will be able to redeem this issue without additional permanent financing at this time and none is now contemplated.

Telephone News From the Southwest

Notes of Telephone and Utility Interests in the Central Southwest Which Previously Were Reported for Transmitter and Electrical Journal, a Regional Magazine of that District Which Has Been Absorbed by TELEPHONE ENGINEER, Appear in the Following Columns

Tidings From Texas

A New "Black Beauty"

A Neophyte, and a humble and lowly one at that, was raised to the exalted plane of a full-fledged membership in the well known Black Beauty club during a one-day cold spell (yes, we occasionally have them in Texas during the summer) in the usual torrid month of July. All of this was necessary to obtain the heights of a flull-fledged member. The moon on a cold night is specifically ordered that the Neophyte may be initiated by lifting the voice and singing "How Dry I Am." Neighbors insisted it sounded like the well known bray of the equine family; however, I insist it was singing, as singing should be done.

On a recent trip to Orange, Texas, the home of the famous Black Beauty Creosoted Pole, and the Texas Creosoting company, the writer was listed as a prospective member of the above-mentioned society. Drinking a cup of the blackest coffee ever, "Black Beauty" coffee, by the way, and signing on the dotted line was a mere formality. Not until I received from D. E. Roach, the secretary, the By-Laws and finished my initiate was I quite sure that I did the honors in good shape.

A long, pleasant visit on the beautiful shores of a picturesque lake where the headquarters of the Texas Creosoting company are located, was the aftermath of a blazing Texas day. Inspection of experiments constantly being carried on was indeed one of interest. Accompanied by Mrs. Nettie M. Lyons, accomplished Director of Publicity for the firm, I was much impressed, as well as served Black Beauty Coffee from Black Beauty service if you please.

Rice M. Tilley, an article writer of no mean distinction himself, also joined the party for coffee and informed us that a new treatise is to be expected by the telephone men in the near future relative to the worth of their famous brand of pole, and also results of experiments seen by the writer while there.

Mr. Manley, genial president, was bearded in his den and dropped his duties long enough to have a pleasant chat; incidentally asking what kind of golf score I shot before inviting me to play. This, beyond doubt, proves astuteness as the writer is famous for his golfing lies, both kinds.

Thanks Mrs. Lyons, Mr. Manley and Mr. Tilley, and also the black beauty who served the coffee, for a very pleasant visit, and the honor of being chosen a "Black Beauty."

R. S.

Incorporated

Harris Fort Bend Telephone company, telephone line, Sugarland; capital stock 250 no par value shares. G. D. Ulrich, Lee Curtis, George Baldwin.

New Lines in Panhandle

New rural telephone lines of the Western Telephone corproation in the southeastern part of Hansford county and across the line in Ochiltree county are soon to be served out of Spearman. Poles and wire have already been installed and boxes will be in operation next week. The new project represents an investment of several thousand dollars and will serve about 20 farmers.

Still Building

There have been two construction crews of the State Telephone company working on a copper toll line from Abernathy to Ralls connecting Petersburg with these two points on the new line. The line is being built directly from Abernathy to Ralls with a connecting line from the nearest point to Petersburg. This work is expected to last for about two months.

Williams to Dallas

E. M. Williams has been promoted from managership of the Dallas office in the Postal Telegraph system to the position as superintendent of district four, according to information received here from Cleveland, where company officials are in conference.

Mr. Williams came to Dallas from Tampa, Fla., a little over one year ago.

Bell Activities in Texas

At Belton, Charles Peyton of the Temple offices, addressed the Belton Rotary club as featured speaker of the day. Subject of the telephone industry and its development was received with much interest.

J. P. Willford, district manager, Tyler, announces effect of new East Texas oil fields in an interview. Day and night shifts have been doubled. Toll calls have trebled. This since last September when the field was discovered.

Location of new phone building for Huntsville announced. Specifications have not been finished, announces A. L. Edmondson, division superintendent. It is understood a new, modern building is planned to be located at 13th street and J avenue.

At Fort Worth permits were granted to open streets for beginning the $250,000 construction task of laying underground cables to two new exchanges to be built in the north and south sections of the city. The two buildings will aggregate a cost of $100,000. Employment of 150 men for 3 months was announced by Don Hunsaker, district manager, to complete the job.

At Galveston, Harry Brickhouse, district manager, announces transfer of district traffic headquarters to Galveston. A new traffic chief, Paul P. Snowden, formerly at San Antonio, was selected with the district including Texas City, Galveston, and 14 other exchanges.

At Sweetwater new underground cables are being installed to connect with the newly erected telephone building. Employment will be given 20 new men on this job with a force equal to that size to assist in installing equipment in the new building.

As Cisco, a sales meeting of district officials from three districts, Cisco, Mineral Wells and Cleburne, was held in the offices of P. Petit, manager of the Cisco district. O. L. Ellis, district traffic chief, and Bert W. Shaefer, both of the Fort Worth district, also attended.

New Lines and Poles

The State Telephone company at Sudan, Texas, is now busily engaged in erecting new poles and stringing new lines and cables all over town, reports G. C. Singer. The cables are to be used only in the business section.

Rural customers in this community build their lines to the company line with a small connection fee of 75 cents.

Through the columns of the local paper, Mr. Singer is getting much co-operation in securing additional rural subscribers and is reporting a steady growth in that class of new stations.

Serving Summer Camps

The Camp Wood Telephone company is now constructing two miles of additional lines to the new Camp Eagle. A large summer encampment of boys is expected as reservations are larger than ever before.

Observations From Oklahoma

Oklahoma Holds District Meetings

Oklahoma telephone men gathered last month at Beggs, Hominy, and Tahlequah, Okla., June 9, 10, and 12, respectively. At each of these cities a district meeting of the telephone division, Oklahoma Utilities association, was held. A total of 222 persons attended the series of meetings.

The principal address at the Beggs meeting was given by Judge V. H. Stone, head of the educational department, Middle West Utilities company, Chicago, who spoke on "Pioneers." C. G. Gardner, Oklahoma City, sales representative, Kellogg Switchboard & Supply company and chairman of the telephone division, presided at the meeting. Sam Hand, manager, Beggs Telephone company, was in charge of local arrangements.

The Tahlequah meeting was held at the Hotel Thompson under auspices of the Southwestern Bell Telephone company. Tahlequah was a fitting scene for a telephone meeting as it was the cradle of the telephone industry of Oklahoma. The first telephone line in the state was installed and operated in 1886 between Tahlequah, Fort Gibson and Muskogee, then the Indian Territory.

E. D. Hicks, a state telephone pioneer and district manager of the Southwestern Bell Telephone company, presided. One of the important addresses was given by Congressman W. W. Hastings.

H. W. Hubenthal, Oklahoma City, presided at the Hominy meeting, and J. L. Zieg, Broken Arrow, superintendent, Oklahoma Telephone company, addressed the meeting.

Each meeting was addressed by a number of other speakers, who discussed topics important to the telephone industry.

The Southwestern Bell Telephone company has completed a $350,000 telephone system at Holdenville, Okla. This new system was cutover late in June. Improvements include a new building, new switchboard and other exchange equipment, and repeater equipment to be used on the new underground cable now under construction from Dallas and Fort Worth, Texas, to Holdenville, to connect with the Oklahoma City-Tulsa underground cable of the company.

Construction has been started by the Southwestern Bell Telephone company on an underground toll cable between Joplin, Mo., and Tulsa, Okla., which will involve an expenditure of $1,500,000. The line will run southwest from Joplin to Vinita, Claremore and Tulsa. The cables will contain 300 circuits or 600 wires and will be part of the new underground cable network being constructed by the Southwestern Bell Telephone company in Oklahoma and other southwestern states. The cable at Tulsa will connect with lines running to Oklahoma City, Holdenville, Fort Worth, Dallas and Cisco, Texas.

Frank Crawford, owner of the telephone exchange at Sulphur, Okla., has started excavation for a new telephone building at Sulphur.

Rapid growth of Oklahoma City has made it necessary for the construction by the Southwestern Bell Telephone company of a new exchange building in Oklahoma City. Work on this building, to be located at 23rd Street and Ollie Avenue, is now underway.

A. E. Hildebrand, aged 82, who installed the first telephone system at Ponca City, Okla., died suddenly in a Denver, Colo., hotel, June 18. Mr. Hildebrand participated in the historic run into the Cherokee strip in 1893 and later operated a pioneer telephone exchange which served Ponca City, Newkirk, Blackwell and Kildare.

SCIENTIST EXPLAINS PROCESS OF TELEVISION

A scientist of the Bell system writing for the Southern Telephone News, explains the sending of pictures by wire and by radio. The process in telephotography, the sending of photographs, and television, the sending of moving pictures, is much the same. He explains it as follows:

"In the processes usually employed in telephotography, the picture may be considered to be divided into a large number of small, equal-sized elements like a mosaic. Unlike the human eye, which sees the whole picture at once, the electrical eye of the transmitting machine is focused on only one element at a time, passing rapidly along row after row of elements, until the whole picture has been scanned. As each element is viewed in turn, an electrical signal is sent out whose strength corresponds to the average shade of that element. Upon reception of the signals, the receiving apparatus recreates the picture elements one at a time, painting each dark or light as directed by the electric signals, and arranges them in proper order to form a picture similar to that viewed by the transmitter."

VAIL MEDALS AWARDED TO NEW YORK HEROES

The heroic acts of two New York Telephone company employes, Joseph N. Nilsen, Westerleigh, S. I., and Joseph Depinto, Brooklyn, have been recognized by the award of Vail medals. These medals are given each year, in memory of Theodore N. Vail, late president of the American Telephone & Telegraph company, to employes of the Bell System who perform acts conspicuously illustrating ideals of public service.

These two cases, both of which involved the saving of human life, were unanimously selected from among 127 cases considered by a committee of twenty employes and three officials of the telephone company.

CONVERSATION RECORDER ON MARKET

The International Telephone & Telegraph corporation, through subsidiary companies, will begin shortly the exploitation of a telephone Conversation Recorder.

By means of this device the conversation of both parties is recorded on a magnetic steel wire in a manner such that the message can be reproduced at any later time. It is possible also to obliterate the message so that the wire can be used over again.

The recent association of Echophon-Maschinen A. G. of Berlin, Germany, which has been furthering the development of this device, with the International System, now makes it possible to provide telephone users with the Conversation Recorder.

One of the important applications of the Conversation Recorder is in connection with long distance cable and radio telephone calls.

Directors of Michigan Bell Telephone company have authorized expenditure of $2,433,000 for new construction. Of the total $1,236,000 is for the Detroit exchange area and $1,197,000 for the remainder of the state. Including estimates approved at previous meetings, approvals so far this year total $3,901,000 divided approximately $2,222,000 for Detroit and $1,679,000 for the remainder of the state.

Elementary Course in Telephone Practice

Problems Testing Ability to Determine Amperes, Volts, Ohms and Resistance in Series Circuits Are Given Here in the Fourth Chapter of a Beginner's Study of the Telephone by O. B. Fensholt, Preceding the Defining of New Rules to Apply to Parallel Circuits

Series Circuits (Ohm's Law)

Now that we have some rules for Ohm's Law as applied to Series Circuits, let us put it in a chart in this manner:

To Find: Equal To:

Amperes.... Same as in each separate part.

Ohms ..... The sum of the ohms of each separate part.

Volts ..... The sum of the volts of each separate part.

Suppose that in Fig. 7 we wish to find voltage across the whole circuit at "V." We can go about this in two ways.

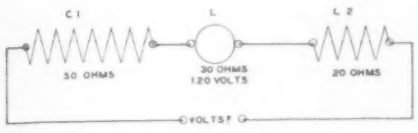

Fig. 7

First: Apply Ohm's Law (V=O×A). Therefore, to find the volts at "V," we must know the ohms and the amperes at "V." Since neither of these are given at "V," it will be necessary that we find these first. According to our rules of series circuits we know that the ohms are equal to the sum of each separate branch. Then the resistance at "B" must be 50 + 30 + 20 or 100 ohms. We also know that the amperes of a series circuit remains the same, so if we know the amperes at any part, it will be the same at "V." There are no amperes given anywhere, so we will have to go to some resistance where we can apply Ohm's Law to find amperes ($A = \frac{V}{O}$). Since the lamp gives us the voltage and ohms, there we can find the amperes. That is, $\frac{120}{30} = 4$ amperes. Since there are 4 amperes in the lamp, there must be 4 amperes at "V." Then (V = O × A) 100 ohms × 4 amperes = 400 volts at V.

Our second method is: According to our rules of series circuits, the total voltage at "V" would be the sum of the volts at each part. The voltage is only given at the lamp (120 volts). We therefore will have to find the volts in the other two. By Ohm's Law (V = O × A) we can find the voltage. We have found that there are 4 amperes at the lamp, therefore there must be 4 amperes at coils C_1 and C_2. The voltage at C_1 must be (V = O × A) 50 × 4 or 200 volts. The voltage at the lamp is given, 120 volts, and the voltage at C_2 is (V = O × A) 20 × 4 or 80 volts. Then the total voltage must be 200 + 120 + 80 or 400 volts.

In Fig. 8, let us find the resistance of coil X.

We can also do this in two ways:

First: Apply Ohm's Law ($O = \frac{V}{A}$).

Therefore, to find ohms at "X," we must know the amperes and volts at "X." Since neither of these are given at "X," it will be necessary for us to find them.

According to our rules of series circuits, we know that amperes remain the same in each part, so if we know it in any part, we know it at "X." The amperes in "C" is 3 amperes; therefore, there must be 3 amperes in "X." We also know that the voltage of a series combination is equal to the sum of the volts of each part. Then, if we know the volts in "C" and "L" we can add them together, and subtract that from our total of 600 volts, and the remainder will be the volts at "X." By Ohm's Law

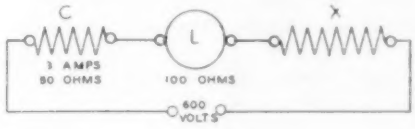

Fig. 8

(V = O × A) coil "C" has 80 × 3 or 240 volts. Lamp "L" has 100 × 3 or 300 volts. Then 240 + 300 = 540 volts in "C" and "L." So 600 volts minus 540 volts, equals 60 volts, or the voltage at "X." Now that we know the voltage (60v) and the amperes (3a), we can find the resistance by Ohm's Law ($O = \frac{V}{A}$) or $\frac{60}{3} = 20$ ohms.

Our second method is: That according to our rules of series circuits, we know that the total resistance of a series circuit is equal to the sum of the resistances of each branch. Therefore, if we can find the resistance of the whole circuit, and then find the total resistance of "C" and "L," we can subtract the total resistance of these two from the combined resistance, and our remainder will be the resistance of "X."

By Ohm's Law ($O = \frac{V}{A}$) the resistance of the combined circuit is $\frac{600}{3} = 200$ ohms. The resistance of "C" or 80 ohms plus 100 ohms at "L" equals 180 ohms. Then 200 ohms minus 180 ohms equals 20 ohms, the resistance of "X."

In Fig. 9, let us find the amount of the amperes flowing through coil "B."

By applying Ohm's Law ($A = \frac{V}{O}$) we would have to know the volts and ohms at "B." Since the volts at "B" are not given we cannot apply Ohm's law at this point.

According to our rules of series circuits, we know that if we can find the amperes one place, we can find it through the whole circuit. We also know in a series circuit that the total resistance is equal to the sum of each separate branch. Therefore, the total resistance will be (12 + 18 + 25) 55 ohms. We know the total voltage is 110 volts. Then the amperes of the circuit, by Ohm's Law ($A = \frac{V}{O}$) will be $\frac{110}{55}$ or 2 amperes. If there are 2 amperes at the combination, there must be 2 amperes at coil "B."

To check our answer, we can use this method:

We know the volts of a series circuit is equal to the sum of each branch. Then, if we find the volts in A, B and C, and add them together, our answer should be 110 volts.

By Ohm's Law (V = O × A) we can find the volts in each branch since we have the ohms given and we found there were 2 amperes of current flowing.

"A" will have 12 × 2 or 24 volts. "B" will have 18 × 2 or 36 volts, and "C" will have 25 × 2 or 50 volts. Then, 24 + 36 + 50 = 110 volts, which is correct.

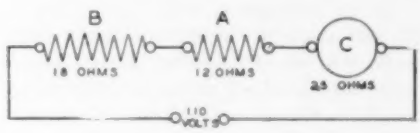

Fig. 9

Problems—Series Circuits

1. If a series circuit line has 3 resistances of 10 ohms, 20 ohms and 30 ohms, respectively, and a total pressure of 120 volts, find:

A. The amperes of the whole circuit.

B. The volts at each resistance.

2. A series circuit has a coil of 6 ohms, a relay of 11 ohms and a lamp of unknown resistance. The total pressure is 220 volts, and the circuit has a current

of 10 amperes. What is the resistance of the lamp?

3. If we add another resistance of 3 ohms to problem 2, what would be the current at 220 volts?

4. A telephone circuit has 3 resistances in series, a relay of 130 ohms, a transmitter of 39 ohms and a primary coil of 71 ohms. How much current will flow with a pressure of 24 volts?

5. What voltage is required to force 8 amperes through a series combination of 12 ohms, 10 ohms and 18 ohms?

6. If a normal telephone circuit producing good transmission has a current of 0.08 amperes (80 milli-amperes) at 24 volts, and poor transmission was caused by adding a resistance which reduced the current to 0.02 amperes, what would be the ohms of the resistance added?

7. A series circuit has 3 resistances, "A," "B" and "C." "A" has 35 ohms, "B" has 40 ohms, and "C" has a pressure of 30 volts. The total current of the circuit is 5 amperes. Find:

1. The total voltage of the circuit.

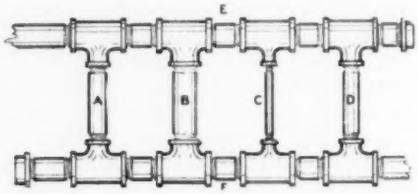

Fig. 10

2. The resistance of "C."
3. The voltage of "A."
4. The current through "B."

8. If a street lighting circuit has 10 lamps connected in series, with each lamp having 12 ohms resistance, and each line wire between the lamps and the power station has a resistance of 2 ohms each, what voltage would be required to force 8 amperes through this circuit?

9. What would be the current in problem 8 if one lamp was short circuited?

10. What would be the current in problem 8 if two more lamps and line wires were added?

11. If a telephone line relay operates on 0.01 amperes (10 milli-amperes) at 24 volts, will the relay operate if a 6000-ohm resistance is added to the circuit? What would be the current with the coil added?

Parallel Circuits—Pressure (Volts)

We now know the three rules for series circuits to assist us in applying Ohm's Law.

We know in a series circuit:

1st. Amperes: The amperes of a series combination remains the same in each branch.

2nd. Volts: The volts of a series combination is equal to the sum of the volts in each branch.

3rd. Ohms: The ohms of a series combination is equal to the sum of the ohms in each branch.

These rules do not hold true for parallel circuits, and it will therefore be necessary that we form new rules to apply to our parallel circuits.

Let us connect up various sizes of pipe together in parallel as shown in Fig. 10.

The pipes A, B, C and D are connected between a pair of pipes E and F, which are at the same level.

If these branch pipes are between the same levels (E and F), the current or the water flowing through them would be caused by the same high level (E). Therefore, the pressure must be the same in all the pipes as it is in E. If we increase the pressure in E, we then increase it the same in each branch pipe.

This also holds true with any electrical apparatus connected in parallel.

Let Fig. 11 represent four pieces of electrical apparatus connected in parallel.

If we put a pressure of 110 volts across E and F, there will be 110 volts across each branch A, B, C and D, because each branch is across the same level (E and F).

We can now set up our first rule for parallel circuits like this:

"The voltage of a parallel combination remains the same as each or any branch."

We then know that if we can find the voltage across any branch of a parallel combination, that it will give us the voltage for the entire combination or for the other branches.

Parallel Circuits—Current (Amperes)

If you will refer to Fig. 10, you will notice that the four pipes are connected in parallel and are of different sizes.

It is natural to see that since C is larger than A, that C will carry more water from E to F than A will, therefore the current will be greater in C than in A. Also, since D is larger than C, D will have greater current than C, and B will have greater current than D. You can readily see, then, that B will have the most current, and A will have the least. Also, notice that the current is different in each branch.

Let us now assume that the currents in these branch pipes are as follows: A has 2 gals. per second, B has 10 gals. per second, C has 4 gals per second and D has 6 gals per second. There must, then, be enough current flowing in pipe E to keep up the current in the other pipes, or there must be 2 gals (in A) + 10 gals. (in B) + 4 gals. (in C) + 6 gals. (in D), or a total of 22 gals. per second must flow in E to keep the branch circuits supplied.

If 22 gals. per second flow through E, there must be 22 gals. also flowing out of F.

You will now notice that the current of this parallel combination then is the sum of the currents in each branch.

Again, this also holds true for our electrical circuits.

We will now refer to Fig. 10, and assume that the current in A is 4 amperes, in B is 20 amperes, in C is 10 amperes and in D is 5 amperes. There must be enough current, then, flowing through E and F to keep the branch circuits supplied, or there must be a total of 4 amperes (in A) + 20 amperes (in B) + 10 amperes (in C) + 5 amperes (in D) or a total of 39 amperes in the combination.

We can then set our next rule for parallel circuits like this:

"The amperes of a parallel combination is equal to the sum of the amperes through each separate branch."

Therefore, to find the total amperes of a parallel combination we must know the amperes of each separate branch.

Parallel Circuits—Resistance (Ohms)

We have now made two rules which apply to parallel circuits, whereby we can find volts and amperes.

For a review, these rules are:

"That the voltage of a parallel combination is the same as the voltage across any branch," and "The amperes through a parallel combination is equal to the sum of the amperes through each separate branch."

Now, we will also want to know how to find the ohms of a parallel combination, and this is neither the same nor the sum of the branches, but can only be found by applying Ohm's Law ($O = \frac{V}{A}$).

Referring back to Fig. 10, we know that pipe A has the greatest resistance and pipe B has the least resistance. Also we know that pipes E and F must be

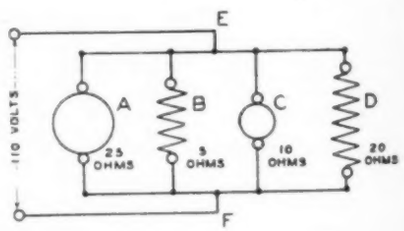

Fig. 11

large enough to keep all the branch pipes, A, B, C and D, supplied; therefore, resistance of EF, must be smaller than the resistance of smallest branch (which would be the largest pipe) or pipe B.

We will now refer to Fig. 11, and let us find the number of ohms across EF or the parallel combination. By Ohm's Law: $O = \frac{V}{A}$. Then if we know the pressure across E and F is 100 volts, and the amperes is the sum of the amperes of each branch, or 4 + 20 + 10 + 15 or 49 amperes, we then know ($O = \frac{V}{A}$)

$O = 100 \div 49$ or $\frac{100}{49} = 2.04$ ohms.

You will notice, then, that in our elec-

trical problems it also holds true that the resistance of our parallel combination is less than the smallest resistance of our branch circuits. Our smallest branch circuit is 4 ohms, and our total resistance is only 2.04 ohms.

The only rule that we can then set up for the ohms of a parallel combination would be:

"That the ohms of a parallel combination can *only* be found by Ohm's Law, and that the resistance of a parallel combination will be *less* than the resistance of the smallest branch."

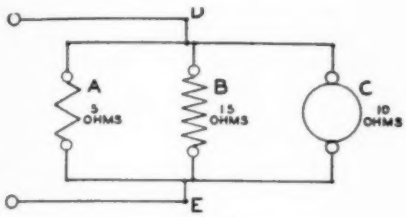

Fig. 12

A number of technical books will give you a formula for finding the resistance of a parallel circuit, but if they were to go into detail, and explain where or how the formula was derived, they would have to start with Ohm's Law.

That the resistance of the combination is less than the smallest branch may sound strange at first, but common sense will show that the more paths or larger paths you put between two pipes or two conductors, the less will be the resistance, hence the greater flow of current.

We might place one exception to our rule, and this is only in cases where the resistances of all the branches are equal. Then you can divide the resistance of one branch by the total number of branches, and your answer will be the resistance of the total combination, but this also is only a "short cut" for Ohm's Law.

Let us take an example: A parallel circuit has a pressure of 120 volts, and 4 branches of 12 ohms each. Find the resistance of the combination.

Since each branch is the same (12 ohms) you can divide 12 by 4 (the number of branches) and you will have an answer of 3 ohms, the resistance of the combination.

Let us check this for proof by Ohm's Law:

Ohms of the combination is $O = \frac{V}{A}$.

The volts of the combination is 120 volts. The amperes of the combination will equal the sum of the amperes in each branch. So let us find the amperes of each branch ($A = \frac{V}{O}$).

120 ÷ 12 or $\frac{120}{12} = 10$ amperes in one branch. Since there are 10 amperes in each branch, and there are four branches, the total current will be 40 amperes. Then the total resistance will be ($O = \frac{V}{A}$)

120 volts ÷ 40 amperes or $\frac{120}{40} = 3$ ohms, which is the same as we had before.

Remember you can *only* divide the resistance of one branch of a parallel circuit by the number of branches, to find the total combination resistance, when *each* branch has the same resistance. Under any other condition you must use the Ohm's Law method.

You will now perhaps bring up the question of how you can find the resistance of a parallel combination when only the resistance of each branch is given, but no voltage or amperes given.

We will let Fig. 12 represent a case of this kind.

We said that in order to find the total resistance of a parallel combination, we must apply Ohm's Law ($O = \frac{V}{A}$).

We know that we must have the volts and the amperes of the combination.

We know that the volts of a parallel combination remains the same, then whatever voltage we find or use across one place it must be the same at the others.

We also know that the current of a parallel combination is equal to the sum of the amperes in each separate branch.

Resistances, we know, are fixed. That is, regardless of what voltage is impressed across A, B, C, we do not change their resistance, but what does change is the amperes.

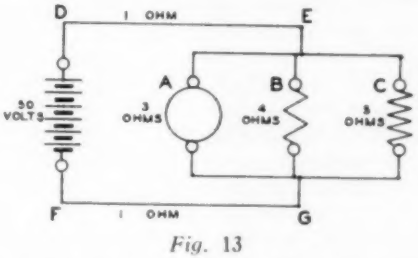

Fig. 13

Let us then *assume* there is one volt across the combination D and E. We then know there must be one volt assumed across each branch. Using one volt for each branch we can find the amperes in each branch at this one volt, by Ohm's Law ($A = \frac{V}{O}$).

Therefore, A will have 1/5 or .2 amperes, B 1/15 or .067 amperes and C 1/10 or .10 amperes. We then know the total amperes at one volt will be .2 + .067 + .10 or .367 amperes for the combination.

Then by Ohm's Law, the resistance of the combination at one volt will be ($O = \frac{V}{A}$) 1/.367 or 2.72 ohms. (You will note that this is less than the smallest or the 5-ohm branch.)

We said that resistances are fixed and cannot be changed by voltage, therefore 2.72 ohms will be the resistance of the total combination regardless of what voltage is impressed across it. To prove this, work this problem out by using various voltages.

When voltages or amperes are not given, it has been recognized to use one volt as a standard, and the term, for the amperes per one volt is "Conductance."

Then, if we wish to know the conductance of a circuit, we mean that we wish to know how many amperes there would flow if *one* volt pressure was impressed.

Problems—Parallel Circuits

We have now covered the rules for parallel circuits, so let us set up our rules in chart form in this manner:

Problems

1. If a parallel combination has three branches, consisting of 2 ohms, 5 ohms and 10 ohms, with 110 volts across the combination, find:
   (a) The volts in each branch.
   (b) The amperes in each branch.
   (c) The amperes of the combination.
   (d) The ohms of the combination.
2. A parallel circuit has 5 lamps of the same resistance. Each lamp takes 2.5 amperes and 110 volts. Find:
   (a) The amperes of the combination.
   (b) The volts of the combination.
   (c) The ohms of each lamp.
   (d) The ohms of the combination.
3. A parallel circuit has 3 branches of 1, 2 and 3 ohms. What is the conductance of the combination?
4. What would be the resistance of the combination in problem 3?
5. If 110 volts were put across the combination of problem 3, find the current of the combination, also the current across each branch.
6. A parallel circuit has 4 resistances consisting of 2, 4, 6 and 8 ohms respec-

(*Continued on page* 31.)

IN A PARALLEL COMBINATION

TO FIND	TO DO
The amperes of a parallel combination:	Take the sum of the amperes in each separate branch.
The volts of a parallel combination:	It is the same as the volts across any branch.
The ohms of a parallel combination:	It is less than its smallest branch and can *only* be found by applying Ohm's Law.*

*NOTE.—Remember that *only* in cases where the ohms of *each* branch is the same you can divide the ohms of one branch by the total number of branches.

Functions of Circuit to Intercepting Desk

Outgoing Jack Circuits to Office Intercept Desk Necessary for Calls with Special Multiple Marking or Special Service Plug in Line Jack, According to John H. Levis, Jr., Tel. Engr., Rochester, N. Y., Who Has Prepared This Article, the Twelfth of a Series, for TELEPHONE ENGINEER

In any "B" trunking system it is necessary to provide outgoing jack circuits to the office intercepting desk. They are necessary because when a call comes in on a trunk and the line called for has a special multiple marking or a special service plug in the line jack (which means to the "B" operator that the party line designation called for is changed or the call must be taken up with the intercepting operator) all of the conversation between the distant calling station and the intercept operator is carried on with the "B" operator off the trunk circuit.

The outgoing trunks to the intercept desk are multiplied before all "B" operators and are arranged with a lamp signal at each jack appearance for identification purposes when the intercept operator wishes to call to the "B" operator's attention that her services are wanted in connection with the call. Of course, if the connection does not require the services of the intercepting operator the signal is not given to the "B" operator and the distant calling station hangs up and the cord circuit at the originating office is taken from the outgoing trunk jack. The "B" trunk will then show disconnect and it will be taken from the intercept trunk.

The lamp signal referred to is supplemented by another feature of the "B" trunk, the automatic cut-in of the "B" operator onto the trunk circuit that is extended to the intercept desk. The cut-in control is operated by the intercept operator. Each trunk terminating at the desk is equipped with recall, listening and hold keys. There are also two lamp signals, incoming and hold.

When a call comes in over a "B" trunk and the order is given to the "B" operator the call is handled as has been described in previous issues of TELEPHONE ENGINEER. It is extended to the intercept desk via a non-busy circuit determined by means of the position audible busy test system.

The trunk is set with some ringing frequency on it, and continues to send ringing current on the intercept trunk, but it is used only for obtaining the audible ringing for the calling station. The incoming signal on the intercept desk is operated by the sleeve of the "B" trunk circuit and is known as sleeve signaling. The trunk signal lamp is not lighted after plugging into the intercept trunk.

The intercept operator now operates the listening key of the trunk on which the incoming signal is lighted. This operation effaces the incoming signal from the trunk. Another circuit known as the impulse ringing trip circuit is placed between the listening key and the operator's talking circuit. This is so arranged that the intercept operator's circuit is not directly connected to the trunk until the ringing circuit of the "B" trunk is tripped. This prevents the intercept operator from being rung in the ear. This circuit also prevents the bridge back part of the "B" trunk circuit from functioning so as not to falsely operate the automatic line message meter in the distant office calling station line circuit. This also applies to the pay station cord circuits arranged for automatic collection and refunding of coins in the prepayment coin box telephones.

The hold key is used when the intercept operator wishes to retire from the circuit and to place an indication signal on it. The hold key operation does not in any way affect the signals in the "B" trunk circuit or distant office signaling.

The recall key of the intercept trunk is non-locking and is used only when the intercept operator wishes to call back the "B" operator on the "B" trunk circuit for the purpose of extending it to the proper line jack or change the party line ringing frequency according to the information that the intercept operator possesses regarding the order. The circuit that functions when this key is operated is placed in the sleeve signaling circuit of the intercept trunk between the outgoing jack circuit and the desk signaling circuit. It is arranged so that only a momentary opening of the sleeve circuit of the "B" trunk is maintained, allowing the sleeve relay to fall away long enough to release the "B" trunk lock-out circuit and again pick up the sleeve relay. The time element of the opening is not determined by the recall key operation. Relays are used for the time element.

The "B" trunk at once cuts in the "B" operator across the intercept trunk. However, this is true only when the "B" operator is engaged in handling another "B" call upon some other trunk. In other words, the intercept call is now handled in the same manner as if the trunk had an originating call on it. The call passing tone goes to the calling station and also to the intercept operator who has the listening key operated at the time the recall key is operated. The intercept operator now tells the "B" operator how to proceed in the handling of the call. The distant calling station is also on the circuit. The "B" operator can pre-select the proper ringing frequency and then withdraw the "B" trunk plug from the intercept trunk and proceed in a standard trunk operation.

The lamp signal associated with the intercept outgoing trunk becomes lighted with the recall key operation. That is used only when a recall appears and the "B" trunk circuit sequence cut-in circuit is delayed in picking up the recall because of a loaded "B" position. The "B" operator uses the cut-in key of the trunk circuit to cut in on it. The operation of a cut-in key in a loaded position holds up the sequence cut-in circuit at the trunk cut-in by it, and cuts the "B" operator off of it and onto the trunk with the manual operation, and when the same trunk is released by pre-selection the sequence circuit again functions on the trunk circuit from which it was temporarily cut off. This feature will be described in a later issue of TELEPHONE ENGINEER.

For the circuit scheme of the foregoing outline of intercept trunk operation, refer to the circuit diagram of the "B" trunk circuit and the intercept desk circuit.

The following is a description of the various circuit operations of a call to the intercept desk.

In order to avoid repetition of previous descriptions of "B" trunk circuit operation of an incoming call and pre-selection of ringing, assume that this function takes place in the "B" trunk and that the trunk plug is placed into the intercept desk trunk jack. The relays of the "B" trunk as shown in the diagram are involved in this operation. The No. 8 sleeve relay of the trunk circuit operates from the No. 2 sleeve relay (slow release) of the intercept trunk. Relay No. 2 also operates, operating relay No. 3, which causes the incoming lamp signal before the intercept operator to light.

The "B" trunk has ringing current on the tip and ring conductors and must be removed from the trunk by the operation of No. 6 relay of the "B" trunk, causing relay No. 7 of the trunk to release. This must be done at the time the intercept operator operates her listening key and at the same time ringing her in the ear must be avoided.

The intercept operator upon taking her position at the desk, plugs her talking set into the operator circuit causing No.

9 relay to operate. This causes No. 6 relay (slow release) to operate, which holds the talking circuit open at No. 6 relay. This relay is held operated until the ringing is tripped.

The operation of the listening key effaces the incoming lamp signal by operation of the No. 4 relay which, when operated, is locked up from the No. 3 relay. This keeps the incoming signal from reappearing falsely when the listening is restored with the trunk taken. The listening key operation connects the trip circuit to the "B" trunk ringing circuit. The No. 7 A. C. relay will operate either in the silent or ringing period of the "B" trunk ringing. No. 7 relay is connected to the ring side of the circuit and to 40 volts minus D. C. and the silent interval of the ringing circuit is 60 volts minus D. C. This circuit gives a difference of potential of 20 volts D. C. This causes relay No. 7 to operate which places a 240 I. P. M. ground to the No. 8 relay, which follows the 240 I. P. M. impulses and in turn places a 2000 ohm non-inductive ground circuit to the ring of the trunk circuit. The ringing on the trunk will trip with the 20 volts D. C. silent period, and as the No. 7 relay is permanently tied to the ring of the circuit when the operator is talking, it will not operate after the ringing in the trunk is tripped, because the battery winding of the No. 2 relay of the "B" trunk on the ring side is also of 40 volt minus D. C. The No. 6 relay is held operated while the No. 8 relay is impulsing because the ringing is not tripped either silent or ringing if No. 8 is impulsing. With the "B" trunk in the ringing period the No. 7 relay will operate on A. C. as there will not be a 20 volts difference of potential as the ringing period uses 40 volts minus D. C. The No. 7 relay is A. C. and slow to release. This is where the 2000 ohm ground impulse circuit comes in on the circuit. The No. 6 trip relay of the "B" trunk will operate through 2000 ohms to ground and when the ringing is tripped relay No. 7 of the "B" trunk releases, placing relay No. 2 of the "B" trunk into the tripping circuit. As the 2000 ohm ground impulse circuit is delayed in being removed from the ring of the trunk circuit it will not cause relay No. 2 of the "B" trunk to operate on its 40 volt battery winding as it is only a half of the total winding and it will not pick up at the impulsing ground of 240 I. P. M. The trunk trip relay No. 6 will operate with the 240 I. P. M. as cited previously in this description. It is necessary to avoid operation of No. 2 trunk circuit relay. When relay No. 8 ceases to impulse, No. 6 relay releases slowly and allows the intercept operator's talking circuit to be placed across the "B" trunk.

The No. 5 12,000 ohm relay operates

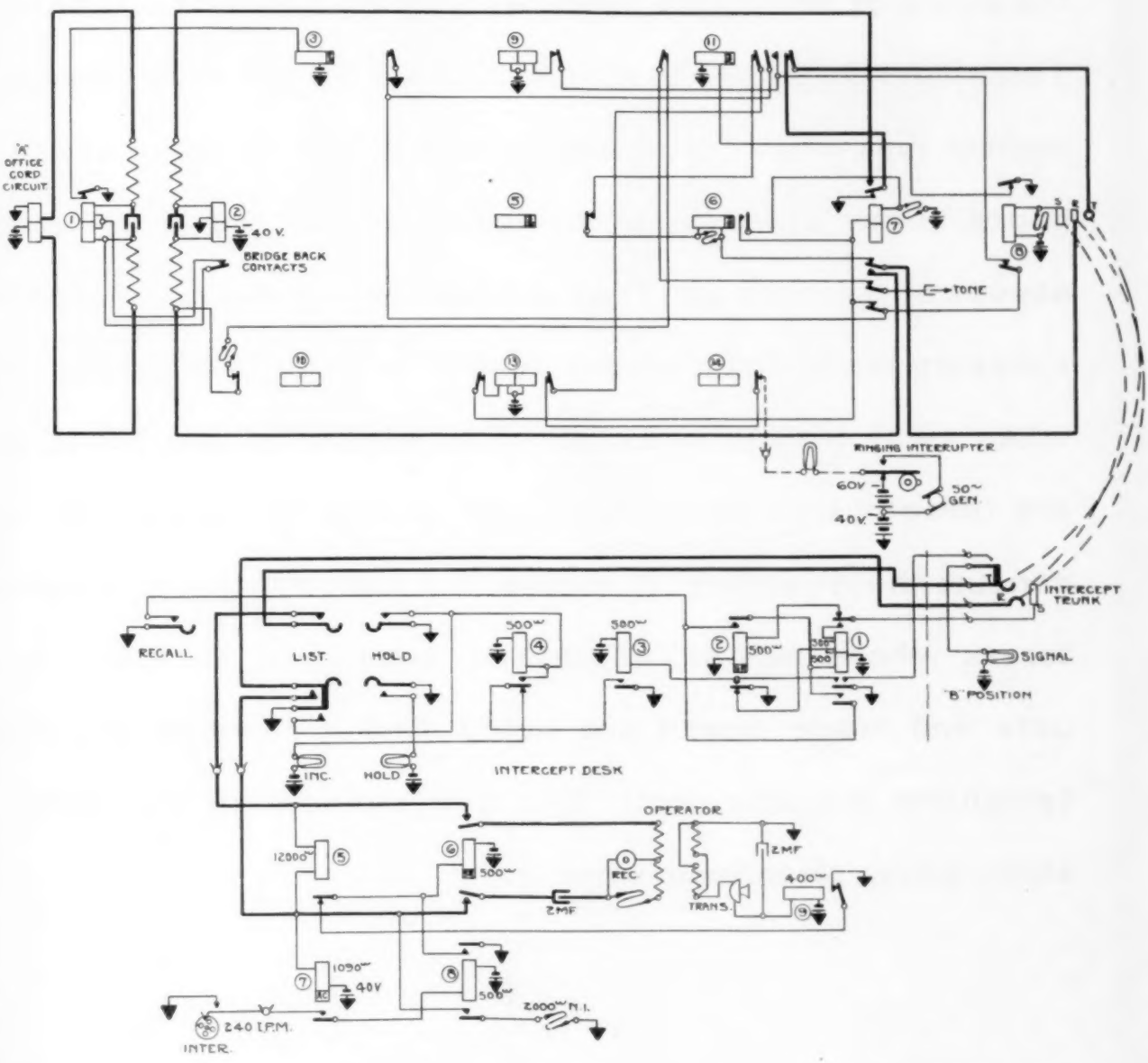

Diagram showing connection of a trunk call to intercepting circuits, recall circuit, ringing trip and operator retard cut-in.

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as soon as the intercept listening key is operated, opening the ground circuit from No. 6 relay; however, if the ringing conditions exist No. 8 relay holds No. 6 relay operated.

The No. 5 relay will not trip the ringing either in silent or ringing periods. Neither will it operate the No. 2 "B" trunk bridge back control circuit. The main function of this No. 5 relay is to allow the intercept operator to cut-in on calls that come to her from a "B" trunk when the non-ring common key was operated. The No. 7 relay of the "B" trunk is not operated in this case. No. 2 relay of battery and ground appears across the intercept trunk.

The intercepting operator's circuit is of the anti-side tone type and was described in the article, "Originating Office Circuits," in TELEPHONE ENGINEER.

The operation of the intercept hold key simply lights the hold lamp signal for holding identification and also operates the No. 4 relay in the event that the hold key is operated before the listening key is operated. This effaces the incoming lamp signal. The listening and hold key are locking and operated from the same key cam handle.

With the No. 8 sleeve relay of the "B" trunk circuit operated, the No. 11 relay (slow release) is also operated from the ground at the double make contact of the No. 8 relay.

It will be noted that when a pre-selection is made, the control lockout relay No. 9 is operated and held locked up from the incoming control ground at No. 3 relay, through a back contact of the No. 11 relay. When the trunk plug is placed in a jack relay No. 8 operates, placing the incoming control ground at No. 3 relay to No. 9 relay hold circuit through a make contact of No. 8 relay with the original No. 9 relay holding circuit through No. 11 relay opened. This is done so that any momentary time element opening of the intercept trunk sleeve circuit will release the No. 8 relay and in so doing will release the No. 9 relay. As described in previous functions of this system of trunking the above will allow the sequence cut-in control circuits to function as in the standard incoming signal operation.

The No. 11 relay is made slow to release so that when the No. 8 relay momentarily opens and then closes, the No. 9 relay hold circuit will absolutely open. As the original hold circuit for the No. 9 relay is at the No. 11 relay, it is obvious that should No. 11 relay release at the same time the No. 8 sleeve relay releases, the possibility of No. 9 relay positively releasing would be remote.

When the above functions in mind and the recall non-locking key in the intercept desk operated, the No. 1 relay of the intercept trunk will operate from the ground at the recall key through the make contact of the No. 2 slow release relay to the battery winding of No. 1 relay. This operation will open the jack sleeve circuit at the break contact of No. 1 relay, allowing the No. 8 relay of the "B" trunk to release. The No. 2 slow release relay releases slowly, giving the time element before No. 8 sleeve relay of the "B" trunk is re-operated. It will be noted that with No. 1 relay operated the sleeve of the jack circuit is transferred to one of its own contacts and hold winding and to a ground circuit on a back contact of No. 2 slow release relay. This operation will again pick-up the No. 8 "B" trunk sleeve relay.

With the No. 1 relay operated the lamp signal associated with the intercept jack will light as previously explained in this article.

The No. 3 relay is also held from the No. 1 relay, to make for proper functioning of the entire signaling circuit. The recall key circuit to the battery winding of the No. 1 relay is also maintained at the No. 1 relay for positive operation of No. 1 relay when the recall key is operated.

The intercepting operator may cut-in and out of a circuit any number of times, because the No. 5 relay will operate, releasing No. 6 relay. Relays No. 7 and No. 8 are not used at this time.

Where the "B" operator removes the trunk plug from the outgoing intercept trunk jack the entire intercept trunk will return to normal.

The method outlined for handling calls to the intercept desk or to any other special circuits is very satisfactory, as it allows the "B" position operator to operate on the same basis for all calls.

INSPIRING MESSAGES FROM FRIENDS OF TELEPHONE ENGINEER

Month by month and year by year TELEPHONE ENGINEER has been making new friends. This is perceptible to the magazine's staff through the continuously increasing number of subscribers. Naturally, this is most gratifying.

In addition, almost every mail brings a letter from one of TELEPHONE ENGINEER'S enthusiastic friends, telling of the pleasure and assistance received from reading this magazine. And it is these personal comments which are the most satisfactory of all.

If your magazine continues to improve it will be at least partly because an occasional word of commendation or praise found its way from another part of the globe to this office, to inspire those who wish to serve you, to serve you better.

The following are a few examples of the voluntary testimonials which have been received recently by TELEPHONE ENGINEER:

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Columbus, Ohio.

The Telephone Eng. Pub. Co.,
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* * *

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* * *

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* * *

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Chicago, Illinois.

Gentlemen: On the eve of my departure from the Philippine Islands I wish to take this opportunity to express to the editor of TELEPHONE ENGINEER and his staff the enjoyment and information I have received from your magazine during my time on the islands.

It has been of especial interest to me to read the many contributions of my old friend Ray Blain, whom I know to be a practical telephone man.

Wishing you continuous prosperity, I am,

Very truly yours,
JOHN W. IRWIN,
Captain (Inf.) Sig. Corps.

* * *

Palo Alto, Calif.

Telephone Engineer,
Chicago.

Gentlemen: For the months of June, July and August please change my address from 885 53rd Street, Oakland, Calif., to the Palo Alto address listed above.

Yours respectfully,
D. H. TOWNSEND.

P. S.—The last five issues of TELEPHONE ENGINEER have been excellent. It's a shame it is not published at least twice a month.

Our Engineering and Management Course

The Operation of Common Battery Switchboards and Their Superiority Over Magneto Boards Is Discussed Here in the Sixth Installment of a Course in Practical Technical Instruction Prepared by B. C. Burden, Transmission Engineer, Lincoln Telephone and Telegraph Company

General

Common battery switchboards differ from magneto boards primarily in the method of signaling and supplying talking battery.

In the magneto board signaling and supervision is accomplished by means of alternating current, and talking current is supplied from local batteries located

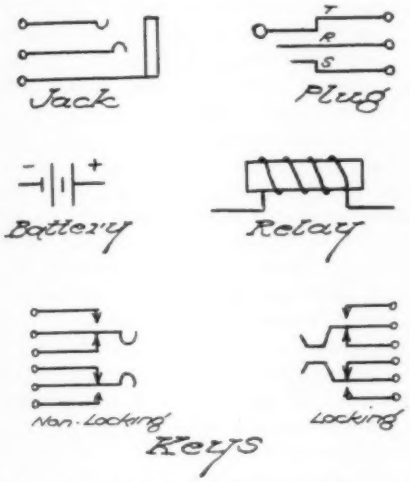

Fig. 1—Symbolical representations of jacks, plugs, battery, relays and keys.

at each station. In the common battery board both signaling and talking currents are supplied from a central office battery which is common to all lines.

As explained in previous articles of this series, the use of a common battery insures more uniform transmission, better supervision and somewhat lower station maintenance costs.

Common battery boards have another outstanding advantage over magneto type boards, viz, the "super-service" features which common battery operation makes possible. Super-service features are machine ringing, secret service, master ringing keys, flashing recall, etc.

The last few years have shown an increasing tendency toward the use of common battery boards in towns heretofore considered too small to justify common battery operation. This trend has been made possible by the introduction of small size common battery boards which are but little more expensive in first cost than similar size magneto boards.

Before covering some of the general features of common battery switchboards, common battery terminology will be discussed.

Apparatus of Common Battery Circuits

For those who have had no actual experience on common battery plants some explanation of the terms used and principal items of equipment may be helpful, before discussing the actual circuits.

Jacks and Plugs—The respective springs and contacts of jacks and plugs are referred to as tip, ring and sleeve, and are represented symbolically as shown in Figure 1. Some common battery cord circuits have only two wires and these are usually known as the sleeve and tip wires.

Battery Designation—The central office battery is usually represented symbolically by a heavy short line and a lighter longer line as shown in Figure 1. The heavy short line represents the negative terminal and the lighter line the positive terminal of the battery. The positive terminal is always grounded.

In referring to the two sides of a common battery circuit it is customary to refer to the negative side as "battery" and the positive side as "ground."

Most circuits are so arranged that the tip line wire (i.e., the wire which connects to the tip spring of the answering jack) is always connected to the positive or "ground" side, and the ring line wire to the negative or "battery" side. Schematic diagrams for simplicity's sake usually show separate batteries in various parts of the circuit, although actually only one main battery is used.

Relays—A relay is merely an electromagnetically operated switch. Relays can

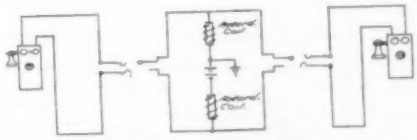

Fig. 2—Simple impedance coil battery feed circuit.

be designed to operate quickly or sluggishly, and on either alternating or direct current. Relays are used to a much greater extent in common battery than in magneto switchboards.

Repeating Coils—The repeating coils used in common battery circuits are similar in construction to those used for phantom circuits, except that they are usually of such size that they can be mounted much more compactly. The turn ratio is in most cases 1 to 1.

Retardation Coils—Retard or impedance coils are used in most circuits to bar currents of voice frequency, and yet permit direct current to readily pass through them. The impedance which they offer to alternating current depends on the type of magnetic circuit used and the number of turns.

Lamps—The lamps used on common battery boards for signaling and supervisory purposes are usually designed to operate on 24, 36 or 48 volts, depending on the voltage of the central office battery. Both carbon and metallized type filaments are used.

Keys—The keys used on switchboards are known as cam type and may be either of the locking or non-locking type. Figure 1 shows how these two types of keys are shown symbolically.

Battery Feed Circuits

There are two basic methods used for feeding battery from the cord circuit to the subscriber's transmitter. These are

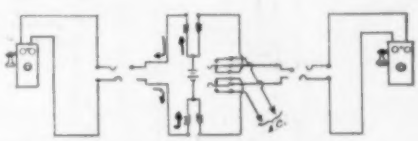

Fig. 3—Repeating coil battery feed circuit.

known as the "repeating coil battery feed circuit" and the "condenser-retard coil battery feed circuit." Another method which has limited application in connection with P.B.X. boards, and other similar service is the simple impedance coil battery feed circuit.

The simple impedance coil battery feed circuit is shown in Figure 2. This circuit consists merely of two impedance coils through which the common battery feeds. These coils are designed to offer a high impedance to voice frequency currents but a much lower impedance to direct currents.

When a transmitter is spoken into, the resulting resistance fluctuation sets up a voice frequency voltage in the line which causes a current of corresponding frequency in the listening subscriber's telephone.

This method of feeding battery to the subscriber's telephone, while very simple, has two outstanding disadvantages which render it unfit for use except on certain types of communicating systems and on P.B.X. boards.

One serious disadvantage is the fact that the direct current resistance of the retard coils is common to both of the connected subscriber's loops, and unless the loops are of the same resistance the subscriber with the shorter loop will get

a disproportionate amount of transmitter current. This would obviously result in non-uniform transmission and for that reason this circuit is not suitable except

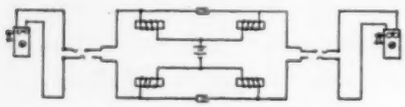

Fig. 4—Condenser retard coil battery feed circuit.

when the connected loops are all of about the same resistance such as is usually the case on P.B.X. loops.

The other disadvantage is the matter of supervision. Due to the fact that the battery feed circuit is common to both answering and calling cords it is necessary to give common supervision. In other words, a single supervisory light is used on each pair of cords, and this light is under the control of both of the

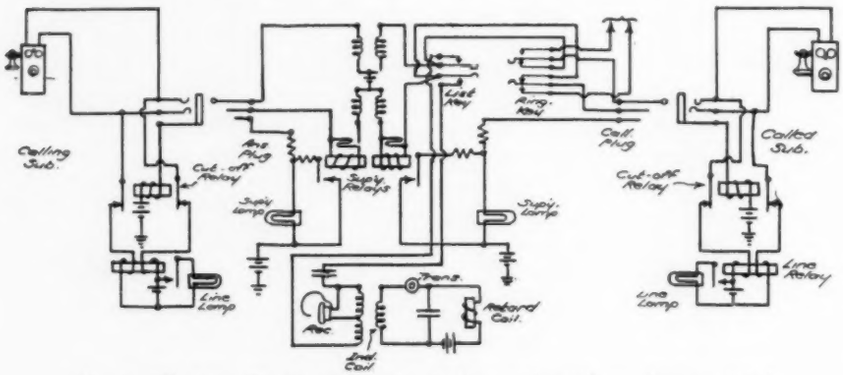

Fig. 5—Western Electric cord circuit (non-universal, no feature type)

connected telephones. If one party should forget to hang up after a conversation this would prevent the other subscriber from signaling the operator.

The repeating coil battery feed circuit is the one in greatest use, although this type of battery feed has no outstanding advantages over the condenser-retard coil circuit.

Repeating Coil Battery Feed Circuit

Figure 3 shows a simple schematic of the repeating coil battery feed cord circuit. Supervisory relays and operators' circuits are omitted from this schematic in order to better show the battery feed circuit.

The action of the circuit shown in Figure 3 is as follows: The central office battery, which is connected to the mid point of the two windings of the repeating coil, causes a current to flow out over the line through one winding and back on the other as shown by the arrow. This current flows through the primary induction coil transmitter of the connected telephone.

When the subscriber is not talking the direct current flowing through the repeating coil windings is constant, and there is no transformer action between the two sets of windings. When the transmitter resistance is varied by the subscriber's voice the direct current flowing through the repeating coil windings fluctuates, and due to transformer action an alternating voice current is set up in the set of windings to which the listening subscriber's telephone is connected.

The turn ratio between the windings connected to answering and calling cords is 1 to 1, hence the windings merely serve to repeat rather than transform the applied voltages.

The internal resistance of the common battery is extremely low, hence there is no chance for crosstalk taking place between different cords fed from the same battery.

Condenser Retard Coil Battery Feed

The basic circuit of the condenser-retard coil battery feed circuit is shown in Figure 4. It will be noted that this circuit consists of two condensers and four retard coils. The retardation coils are designed to offer a high impedance to voice frequency currents but a fairly low resistance to direct currents.

This circuit operates in the following manner: With the cord circuit connected to a subscriber's line and with the receiver off the hook, but with no voice input, current will flow from the common battery through the retard coils to the subscriber's telephone. As a result of the battery being connected across the two condensers, these condensers will acquire a static charge. When the transmitter connected to either the calling or listening cord is spoken into, its resistance will change and the current flowing to the transmitter must change.

Inasmuch as the resistance fluctuations occur at voice frequency it is not possible for the increased or decreased demand for current to be supplied by the common battery because of the retarding or choking effect of the high impedance coils through which the battery feeds. This variable demand for current is therefore supplied by the condensers from the static charge which they hold. Being in series with the line it is obvious that any change in the charge on one set of plates will result in a corresponding change in the corresponding plates of the same condenser. This equalizing of potentials on the condenser plates causes an equalizing current to flow through the listening subset, thus are the current variations on the talking cord passed to the listening cord in the form of an alternating current voice wave.

Stating the theory of this type of battery feed circuit in fewer words and somewhat differently, we could say: "When a transmitter is spoken into the resulting resistance variations disturb the voltage equilibrium of the two condensers. This causes an equalizing current of voice frequency to flow through the receiver of the listening subset."

Supervisory Features of Common Battery Cord Circuits

Let us next consider the supervisory features of the simpler types of common battery cord circuits and the line circuit used in a common battery plant.

There are many varieties of cord circuits and to explain them all would require considerable time and space. An explanation of several of the more common types should enable anyone to readily grasp the operating features of those not explained.

Figure 5 shows the schematic of the cord circuit used in certain types of Western Electric switchboards. The associated subscribers' line circuits are also shown. The line circuit shown is the

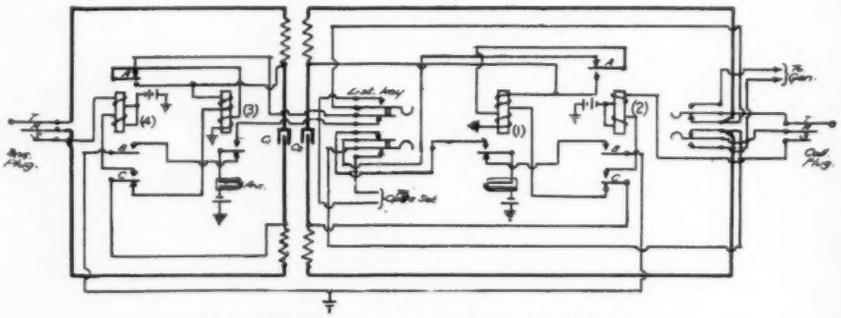

Fig. 6—Universal type cord circuit (Kellogg)

type found in most common battery plants.

The operation of this type of circuit is as follows: When the subscriber removes his receiver from the hook, direct current flows from the central office battery through the double winding of the line relay, through the normally closed contacts of the cutoff relay and out to

the calling telephone. This flow of direct current through the line relay causes it to operate and closes a contact which lights a line lamp associated with the subscriber's answering jack.

The operator on receiving the line signal places her answering plug into the answering jack associated with the operated signal. The sleeve of the answering plug has battery connected to it through a non-inductive resistance and a supervisory lamp, therefore when it is plugged into the answering jack a circuit is completed from through the battery, lamp, resistance and the winding of the cutoff relay to ground.

The resulting current flow operates the cutoff relay which removes battery and ground from the subscriber's line and causes the line relay to release and the line lamp to go out. The calling subscriber's receiver being off the hook, current will flow from the repeating coil battery through the supervisory relay and out to the subscriber's telephone.

This flow of current through the supervisory relay causes it to operate which throws a low resistance short around the supervisory lamp, causing it to go out, thereby indicating that the calling subscriber's receiver is still off the hook. The operator throws her listening key and requests the subscriber's number. When the number is obtained the operator plugs the calling plug into the called answering jack and rings the called party by operating the ringing key. Plugging into the called party's jack operates the cutoff relay by means of the same sleeve connection as explained for the answering cord. The supervisory light associated with the calling cord stays lit until the called party answers at which time it goes out. At the completion of the call both parties hang up and the supervisory lights associated with the cord pair both light, indicating to the operator that the cords should be taken down.

It will be noted that the circuits of the answering and calling cords are practically identical with the exception that the calling cord has the ringing and listening key associated with it.

The circuit shown in Figure 5 represents the fundamental features of a Western Electric manual cord circuit. Actual cord circuits may and usually do have many other features such as machine ringing, universal service, secret service, etc. These special features will be described in a later article.

Universal Type Cord Circuits

Common battery boards which are used in the smaller towns usually have cord circuits which are designed to work on either magneto or common battery circuits. This type of cord circuit is usually known as the "universal type."

Their use is necessary because rural and toll lines are usually of the magneto type.

Figure 6 shows the schematic circuit of a typical universal type cord circuit of a popular make of switchboard.

The operation of this circuit is as follows:

Rural Calls—When a call is received on a magneto line the operator plugs in connecting the tip, ring and sleeve to the tip ring, and sleeve of the jack. This places one winding of relay 3 across the condenser, *C*. The sleeve of the magneto jack being open, relay 3 does not operate. The operator operates her listening key and after obtaining the desired number plugs into the desired jack and rings.

If a rural number is being called, relay No. 2 will not operate due to the sleeve of the jack being open, and relay 1 will be bridged across condenser C2. At the end of the call, if either of the subscribers wishes to signal the operator before the cords have been taken down they may operate their hand generator which will cause either relay 3 or 1 to lock up under the control of the operator's listening key.

This causes the supervisory lamp to light, notifying the operator that she is wanted. This locking-up circuit can be traced from battery through the lamp, through the closed contact of relay 3 or 1, through the normally closed contact of the listening key, through the closed contact of relay 4 or 2, and through the second winding of relay 3 or 1 to ground. It should be noted that a single impulse from the subscriber's generator is sufficient to cause the relay to "lock up." As soon as the operator answers the call by opening her listening key the circuit is opened and the armature of relay 3 or 1 falls back, and the lamp goes out. The operator after obtaining the desired number again closes her listening key and the circuit is in condition to again be locked up should the subscriber signal.

It should be understood that relays 1 and 3, 2 and 4, function in the same manner, although one is on the answering and the other the calling cord.

Common Battery Calls

When a call is received on a common battery line, the operator plugs in which passes battery through relay 4 to ground through the cutoff relay and cuts off the line relay and puts out the line lamp. (This action was explained in connection with the W. E. board, and practically all common battery line circuits follow this same plan.)

The current flowing through relay 4 causes it to operate, closing contacts *a*, *b*, and *c*. Contact *a* connects ground to the tip side of the line through relay 3, contact *c* connects battery to the ring side of the line through relay 4, and contact *b* connects ground to one contact of relay 3.

Relay 3 operates at the instant the plug is placed in the answering jack due to the current flowing to the subscriber's transmitter. The operation of this relay opens the supervisory lamp contact and the lamp remains dark, indicating that the subscriber's receiver is off the hook.

The operator opens her listening key and upon obtaining the desired number she places the calling plug in the desired jack and rings. The action of relays 1 and 2 in this case are the same as on the answering cord with the exception that relay 1 does not operate as there is no current flow toward the called subscriber's telephone until the receiver is removed. The calling supervisory lamp therefore lights due to the connection of ground through the contacts of relay 2. This lamp goes out the instant the called subscriber answers.

At the completion of the call when both subscribers hang up the supervisory lamps both light due to relays 3 and 1 releasing. This notifies the operator to take down the cords.

Questions

1.—What advantages do common battery boards offer over magneto boards?

2.—What is the purpose of the condensers in the condenser-retard coil battery feed cord circuit?

3.—What ratio repeating coil is ordinarily used in the repeating coil battery feed cord circuit?

4.—What are the disadvantages of the simple impedance coil cord circuit?

5.—Why is a cutoff relay necessary?

6.—What is the meaning of "universal cord circuit"?

7.—What terminal of the central office battery is connected to ground?

8.—How does a retard coil function?

9.—Explain the use of the terms "battery" and "ground" as ordinarily used in connection with C. B. circuits.

10.—Is the positive or negative side of the battery connected to the tip of the usual cord circuit?

VACUUM TUBE THEORY AND PRACTICE

(*Continued from page* 23.)

tively. What is the resistance of the combination?

7. What is the conductance of each branch of problem 6?

8. A parallel circuit has 3 branches, one of 5 ohms, one of 10 ohms, and the third unknown. The total resistance is 3 ohms and the pressure is 120 volts. What is the resistance of the unknown?

9. A parallel circuit consists of 4 branches, of 5 ohms, 10 ohms, 20 ohms and the fourth of 18 amperes. The total resistance is 2 ohms. Find:

(a) The resistance of the 18-ampere branch.
(b) The voltage of the combination.
(c) The amperes through each branch.
(d) The amperes through the combination.

Characteristics of Strowger Relays*

Discussion of the Various Methods Used to Determine Mechanical Adjustment Values of Horizontal Relays Together with Reference Tables Governing These Values

By K. W. GRAYBILL
Research and Development Department, Automatic Electric, Inc.

After the non-operate ampere turn value is selected for a given spring load it is usual practice to select a value of operate ampere turns 10 per cent greater than the non-operate value. Where two or more make-before-break assemblies are in the pile-up a difference of 15 per cent is used. These operate and non-operate ampere turns values are the adjust values for the relay and must be translated into operate and non-operate current when the coil values are known. The operate value assures operation on all values of ampere turns larger than itself and prevents the introduction of excessive spring pressure during adjusting. For maintenance and manufacturing purposes it is also necessary that inspection values be specified for testing the operate and non-operate performance. It is usual to specify an operate value of ampere turns for inspection 10 per cent greater than the adjust operate value and a non-operate value of ampere turns for inspection 10 per cent less than the adjust non-operate value. The 10 per cent difference between adjust and inspection values eliminates costly rejections during manufacture which might otherwise occur due to variations in coil temperature, variations in degree of magnetization previous to the application of current test values and differences in opinion between individual adjusters and inspectors. During maintenance, relays should always be inspected by using the inspect values and when found out of adjustment by such inspection, relays should be readjusted to meet the adjust values. Such practice during maintenance eliminates costly unnecessary adjustment of relays because relays which meet the adjust values will operate for long periods of time before wear causes the relays to fail to meet the inspect values.

A typical relay adjustment form as used in the manufacture of relays appears in figure 5. On this form is recorded the schematic of the spring assembly, the value of residual air gap and the various armature air gap values which are to control the adjustment of the springs. The resistance of the coil is given along with the size of wire and the number of turns of wire. Operate and non-operate adjust (readj.) and inspect (test) values are given in terms of resistance to be used in series with the coil on 46 volts, the current which flows under these test conditions and the values of ampere turns resulting from these current values.

To assure satisfactory operation of a relay assembly, a coil is selected which develops at least 20 per cent more ampere turns than the inspect operate value when considering the lowest voltage and highest series resistance that will be encountered in practice. Usually coils are used which develop fifty per cent to several hundred per cent more than the required number of ampere turns specified for the inspect operate value. The ampere turns produced by any coil under circuit conditions are calculated by dividing the available voltage by the total resistance in the coil circuit, thus obtaining a value of current, and multiplying this value of current by the number of turns in the coil.

The irregular curve in figure 6 illustrates the build up of armature load for a rather large spring assembly (G of figure 1) using 22 gauge back contact springs, 28 gauge armature springs and 26 gauge make contact springs with an assumed back contact pressure of 35 grams per back contact. This curve was calculated from the data discussed in article 2. It will be observed that the stroke or armature air gap at which each spring operation course occurs is obtained by adding the air gap specified in the spring assembly to the specified residual air gap.

The smooth curve in figure 6 discloses the force developed at the armature bushing for various stroke values by the non-operate adjust value of ampere turns for this assembly.

The two curves in figure 6 touch at the stroke value at which springs 8 and 9 just break, thus illustrating the balance of forces which must exist with the non-operate current applied to the coil. If a non-operate value of ampere turns were selected to correspond to the load at the time springs 5 and 6 just break it is obvious that the adjuster

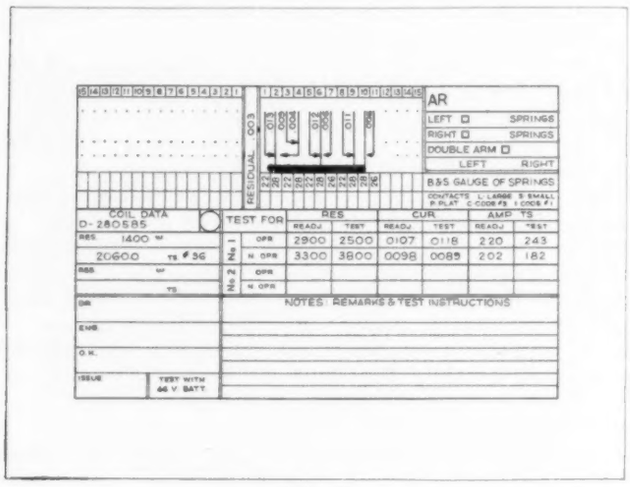

Fig. 5

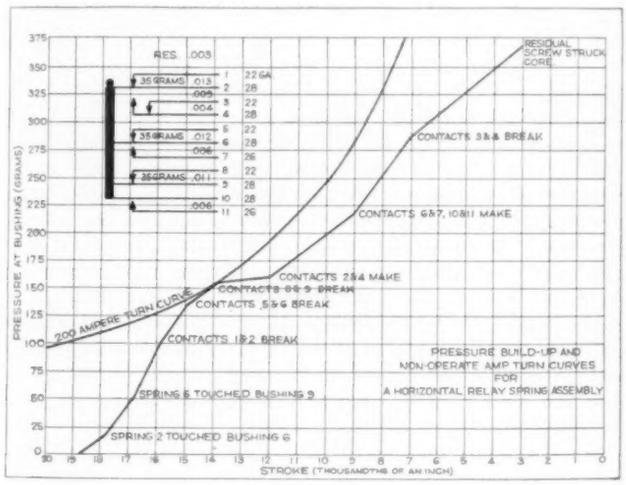

Fig. 6

*Editor's Note: This is the second half of article 3 of a series by Mr. Graybill dealing with relay characteristics. The fourth article will appear in the next issue.

Book Review

Artificial Resins, Their Typical Properties, Chemical Constitution and Uses, by Johannes Scheiber, Ph. D., Extraordinary Professor at the University of Leipzig, and Kurt Sandig, Ph. D. Translated from the German by Ernest Fyleman, B. Sc., Ph. D., F. I. C. 446 pages with appendix and illustrations. $9.00.

This volume deals with the artificial resin industry which is a modern development, having started as recently as 1890. The industry at first was confined to the manufacture of substitutes for the various natural resins. Gradually, however, it was discovered that artificial resins had properties unknown in natural resins and indispensable for many purposes, for example, the manufacture of electrical machinery.

This volume explains how and why the resinous, pitchy products which are the bugbear of the orthodox organic research chemist, and which he is inclined to treat with chilly contempt, have become the basis of an important industry and are deliberately produced by tens of thousands of tons annually.

The book presents a comprehensive account of the principles underlying the artificial resin industry and of their application in practice.

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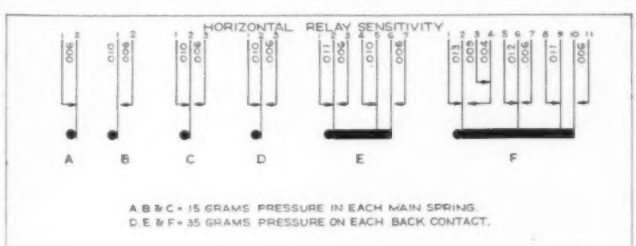
could meet such a requirement with almost no spring tension in armature spring 10 since this armature spring is supplying very little of the armature load at that time. The non-operate value is therefore associated with the load at the time the outside break contact opens so as to provide definite control of the back pressure in all armature springs. The total amount of spring pressure required to meet the non-operate requirements is distributed in approximately equal amounts to the various back contacts in a large assembly by the adjuster. The adjuster judges this distribution by the "feel" of the pressure exerted on the various back contacts in an assembly. Additional assurance of satisfactory distribution of pressure is provided by requiring 35 grams per back contact because of the fact that it is difficult to adjust a standard spring to 45 grams or more. It is therefore easier for the adjuster to put correct pressure adjustment on each spring that it would be to adjust one spring to a large pressure value and another spring to a low pressure value.

Such detailed calculation as illustrated by figure 6 is only necessary for special relays as tables similar to that in figure 2 and the data in figure 4 (see June issue of TELEPHONE ENGINEER for these figures) permit direct calculation of non-operate values for the majority of relays.

Figure 7 records the ampere turns required to operate six different assemblies; the current values required for a particular coil to produce these various values of ampere turns; and the current values required for eight different coils to produce the ampere turns necessary to operate one particular assembly. The ampere turn values given are just large enough to operate the assemblies in each case and do not represent the current which should be provided under actual operating conditions. Attention is called to the difference in ampere-turn requirements between assembly C which has 15 grams back contact pressure and D, which has 35 grams back contact pressure. The last part of the table lists eight different coils, each of which was wound approximately full of a certain size wire. Attention is called to the great difference in current required by the different coils to produce a given value of ampere turns. The 12,000 ohm coil in assembly B would be suitable for operation in the plate circuit of a vacuum tube where a current of .0015 amperes or more is available. The 1400 ohm coil in assembly B would operate very well on 24 volts. The 500 ohm coil in assembly B would operate very well on 6 volts.

The fourth article of this series will discuss the use of special coils to provide slow release and slow operation of horizontal relays and also the durability of the relay mechanisms and coils under severe operating conditions.



COMBINATION	COIL	TURNS	WIRE	OPR. AMP	AMP. TURNS
A	700 ohm	15200	# 34 E.C.	.0043	65
B	700 ohm	15200	# 34 E.C.	.0048	73
C	700 ohm	15200	# 34 E.C.	.0050	76
D	700 ohm	15200	# 34 E.C.	.0080	121
E	700 ohm	15200	# 34 E.C.	.0115	175
F	700 ohm	15200	# 34 E.C.	.0138	210
B	30 ohm	3410	# 27 E.C.	.0220	75
B	58 ohm	4700	# 28 E.C.	.0160	75
B	200 ohm	8400	# 31 E.C.	.0090	75
B	500 ohm	13200	# 33 E.C.	.0057	75
B	700 ohm	15200	# 34 E.C.	.0049	75
B	1400 ohm	20600	# 36 E.C.	.0037	75
B	4150 ohm	34700	# 38 E.C.	.0022	75
B	12000 ohm	63500	# 40 E.C.	.0012	75

Fig. 7

FINNISH TELEPHONE CALLS INCREASE IN 1930

Local calls handled during 1930 by the Telephone Association of Helsingfors amounted to 60,045,730 as compared with 56,151,602 in 1929 and 51,931,158 in 1928. There is a movement on foot to bring all the telephone lines into one organization, having the controlling interest in the hands of the Finnish Government but operating it as a private enterprise. The Siemens-Halske, the L. M. Ericsson firms and an American firm have bid for concession to operate the country's telephone lines, but as yet nothing has been decided.

E. R. CURTIN OF LIMA DIES JUNE 7

E. R. Curtin, president of the Lima Telephone & Telegraph company, Lima, Ohio, died June 7 at the St. Rita's hospital at Lima, following a serious illness of two weeks.

Mr. Curtin entered the telephone industry by way of the oil fields. Starting as an oil pumper in the Lima oil fields, a few years later found him superintendent of the Manhattan Oil company at St. Marys. Later he was made vice-president and general manager, which position he held until the company's dissolution.

He was one of the organizers of the Medina Gas & Fuel company, which later was sold to the H. L. Doherty group. In 1915 he became president of the Lima Natural Gas company, continuing to serve the company in that capacity after Samuel Insull acquired control in 1922.

Two years later the West Ohio Gas company was organized with Mr. Curtin as president. In 1903 he was one of the organizers of the Lima Trust company, now the Lima First American Trust company, and in 1918 he was elected president. In February, 1918, he was chosen as a director of the Lima Telephone & Telegraph company, and in June, 1924, following the death of D. J. Cable, he was elected president.

RECEIVER FOR OKLAHOMA TELEPHONE CO.

T. B. Mumma of McAlester, Okla., has been appointed receiver for the Continental Telephone company, operating exchanges in 18 small Oklahoma towns, by the district court of Oklahoma.

Assets of the company were set at $284,075.46 against liabilities of $175,477.12. Headquarters for the company are in Oklahoma City.

The Continental Telephone company is a subsidiary company of the Municipal Telephone & Utilities company of Kansas City, Mo., of which Harry L. Donnelly has been made receiver.

Telephone Activities in Foreign Countries

Dispatches from Abroad Keep Telephone Men in United States Constantly Informed Concerning Telephony of the World; Domestic Telephone Problems Oftentimes Can Be at Least Partially Solved by Watching the Outcome of Experiments Made Elsewhere

Service from Siam to Germany and the Netherland Indies

Radio telephone service has been opened to the public from Bangkok to Germany and to the Netherland Indies. Messages to Germany are transmitted between 4 and 5 p. m., and to the Netherland Indies between 5 and 6 p. m. Arrangements for a telephone call to the above places must be made four hours in advance.

Swedish-American Line to Install Telephones on Steamers

The Swedish-American Line, Goteborg, plans to install wireless telephone equipment on its passenger steamers. The wireless telephone already has been used to a considerable extent in Sweden for maintaining contact with vessels in the Baltic. For this particular purpose there are stations in Boden, Harnosand, Vaxholm and Karlskrona. The system used at these stations gives good service when the distance does not exceed 200 kilometers, and it is comparatively inexpensive.

Inaugurate Telephone Service from Paris to Bucharest

Direct telephone service has been inaugurated between Paris and Bucharest. The first conversation is reported to have been between the President of France, sitting in the Elysee, and the King of Rumania in his palace at Bucharest.

Telephoto Business in Japan Proves Unsatisfactory

A telephoto service has been in operation between Tokyo and Osaka since August 31, 1930. The largest item of business handled has been press pictures followed by business catalogs, specimen copies and original telegrams. The amount of business has been unsatisfactory inasmuch as there have been an average of only seven messages per day between the two cities.

In November tests were made by a radio service between Nagoya and Bangkok, Siam. The direct transmission of radiograms was reported to be entirely successful.

Underground Cables in Yugoslavia Being Installed

The Yugoslav Government, in conformity with its international agreements, which oblige it to lay cables to connect the Central European with the East and South Balkan countries, has now opened tenders for the laying of underground telephone cables. It is reckoned these works, which involve the laying of about 1,000 miles of cable, will occupy at least four years and will cost around $12,320,000.

Ministry of Communications for Spanish Republic

One of the first acts of the Provisional Government of the Spanish Republic which took over the Government of Spain on April 14 was the creation of a Ministry of Communications. The services of mail, telegraph and telephone have heretofore pertained to a bureau within the department of the interior.

Radio-Telephone Between Bogota and Medellin

Radio-telephone service was inaugurated between Bogota and Medellin, Colombia, in April, through service established by the Colombia Radio corporation of Bogota. This company has been negotiating with the government to contract for extending to other cities in the country communication by this means.

Oporto Connected with European Telephone Net

Telephone service with all the principal cities in Europe, which has been so anxiously awaited, has been opened to the public of Oporto, Portugal. Charges for a three-minute conversation vary between $1.00 and $2.00. Urgent calls are accepted for most countries at three times the regular toll.

Malacca Subscribers Transferred to New System

The transfer of all subscribers connected to the telephone exchange at Malacca to a completely new and up-to-date system was recently carried out successfully without any serious interference with the service. The new equipment has a capacity for 500 subscribers' lines with all necessary service facilities.

Additional Facilities Needed Between Poland and Germany

In addition to the two telephone cables already in use between Warsaw and Berlin, via Posen, two new high-frequency serial lines are shortly to be installed, each of which will allow several conversations to be carried on simultaneously. The extension of the service is necessitated not only by its increased use between the two countries, but also between Poland and Great Britain, France, and the Netherlands.

New Zealand Telephone Connection Postponed

Telephone service between England and New Zealand has been postponed repeatedly because of certain static interruptions which are inconsistent with permanent and reliable service. This does not mean that vocal communication with England and New Zealand is impossible, according to authorities. Speech has been made experimentally on more than one occasion by the officers in charge. However, conversation has not been sufficiently satisfactory to insure a reliable every-day service. Experimentation is being continued in order to perfect weaknesses in the connection.

British Development in Overseas Telephony

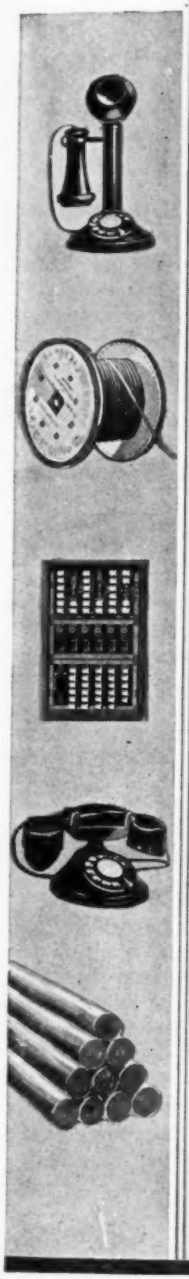
Considerable interest has been aroused in Great Britain by the recent remarkable developments in overseas telephony. A recent demonstration which attracted extensive notice in the British press was held at the London overseas trunk exchange. A telephone operator, sitting before a switchboard measuring only 20 inches by six inches, talked to more than 20 European cities in less than a minute.

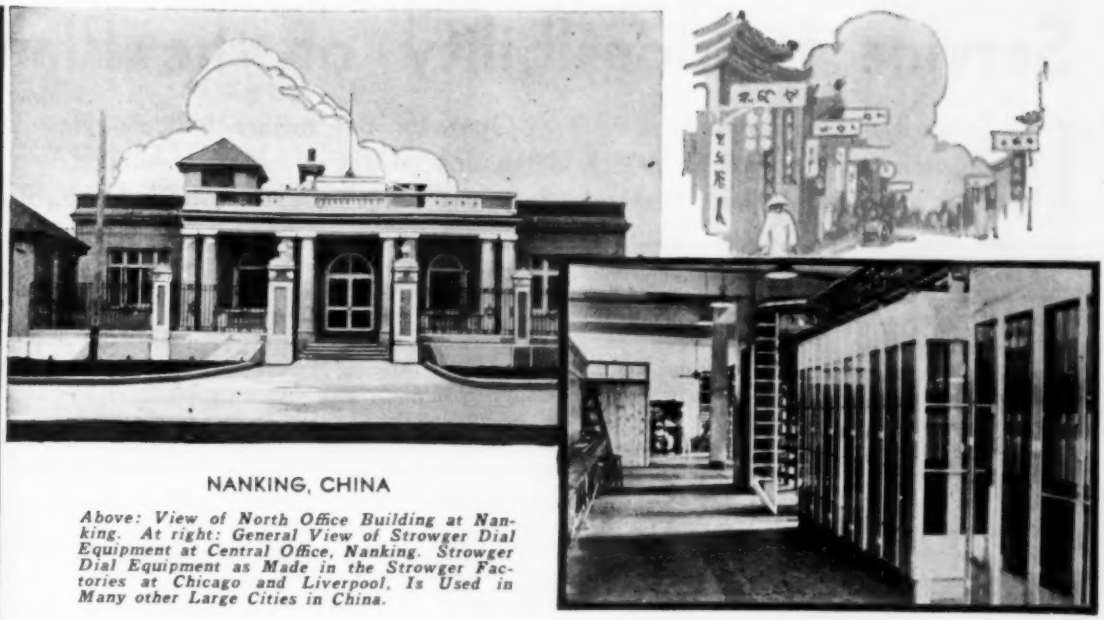
Czechoslovakia Extends Telephone Facilities

Czechoslovakia long-distance telephone services were improved in 1930 by the inauguration of a second direct telephone line between Prague and Paris and by new services from all stations of the Republic to North America and Australia, by way of London, the introduction of a third cable line with Germany, and a substantial reduction of fees for night conversations.

Hong Kong to Have Radio Telephone Connection with World

It was predicted at the annual meeting of the Hong Kong Telephone company, at Hong Kong on March 11, that within two years Hong Kong telephone subscribers would be able to ring up all the important cities of the world by radio telephony. The chairman stated that consideration had been given by the company to the field of long distance radio telephony and, subject to eventualities involved in certain negotiations now being conducted, it was reasonably to be expected that in two years a telephone subscriber in Hong Kong would be able to put a call through to another subscriber in England with a subsequent extension to embrace all important cities of the world, according to "Reuter."





NANKING, CHINA

Above: View of North Office Building at Nanking. At right: General View of Strowger Dial Equipment at Central Office, Nanking. Strowger Dial Equipment as Made in the Strowger Factories at Chicago and Liverpool, Is Used in Many other Large Cities in China.

Nanking's New Telephone System Is Strowger Equipped

THE progressive spirit of modern China is nowhere better illustrated than in Nanking's new dial telephone system. In this important city, three Strowger Automatic Dial offices (Central, Hsiakwan and North) have been installed and are now in operation, providing the finest modern service to approximately 10,000 telephone users. Other cities in China using the Strowger system include Shanghai, Foo Chow, Foo Shun, Chang Zu, Dairen and Harbin—as well as Hongkong, Tientsin and Hankow.

In supplying Strowger Dial equipment to telephone administrations in every part of the world, this organization has built up widespread sales and service facilities. It brings to bear on every telephonic problem submitted to it the benefit of direct contact with the foremost telephone engineering staff in the world. Not only for dial systems, but also for every phase of both inside and outside plant activity, its advice is up-to-date and dependable to the highest degree, while the products it distributes are of the finest in both design and quality. Prices and tenders gladly submitted upon request.

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The New Antwerp Telephone and Electrical Works, Antwerp
Eugene F. Phillips Electrical Works Limited, Montreal

Service Responsibility of the Plant Man

All Subscriber Complaints Not Fault of Operator But Rather Indicate Flaws in Building or Maintenance of Equipment Which Is the Job of the Plant Man According to This Article by Leo K. Farnan, Plant Methods Supervisor, Rochester Telephone Corp., Rochester, N. Y.

Service has a genuine appeal to the imagination. Everyone likes to feel that his efforts have resulted in satisfaction to someone else; that he had added in some way to the sense of security or well-being of individual, group or community; that he has filled a need.

It is possible that service had its introduction to industry through the telephone field. To telephone people it has a specific importance. However, exploitation of the advertising value of service by the trade has narrowed its meaning to some extent so that telephone service, in the public mind, has come to be associated directly with the operator. Plant men know that many subscriber complaints, which to them indicate equipment failure or breakdown of the coordinated plan, carry the impression that the operator was at fault. This is most unfair to her. She may be the "Original Voice with a Smile" girl; she may be operating intelligence and efficiency personified; but, unless plant and equipment are built and maintained in accordance with well-established standards she cannot give good service. Unfair also because service includes every member of the telephone family, an organization which exists for the sole purpose of bringing to its customers the use of facilities for the personal transmission of intelligence. That is our product; that is what we sell and it may be that this direct sale of service has lost its significance for the public in the advertising matter of trade. The public has come to think of service as the immediate need.

The operator has no more responsibility for service than her skill and dexterity in making efficient use of the plant and equipment provided; it is therefore unfair to arbitrarily place the blame for poor service upon her. So it is with the other members of the organization in their respective responsibilities.

The Ever-Present Problem

It is apparent to telephone folks that our chief responsibility for service is in providing good plant and equipment, properly installed and maintained. Granting the first two, the most important and ever-present problem of service responsibility, is maintenance. Maintenance, undoubtedly, has more to do with the quality of service than any other factor. The plant man must not only do a good job in the repair work of restoring interrupted service, but he must be alert to conditions which are likey to result in service interruptions. The greater his foresight in these matters the more economical maintenance costs will be. The fewer reported troubles there are the greater the amount of time available for planning and carrying on maintenance work, and with the exception of the work resulting from heavy storms, much can be done to level the seasonal peaks and valleys in the plant work schedule.

There can be no argument against the statement that the plant man's responsibility for service primarily means that he must do all of the things necessary to prevent interference with transmission service. It is not a new thought. Every plant man has learned as much, very early in his telephone experience. He does know, too, that frequently he has so much trouble to be cleared that there isn't time for anything else. True consideration of service urges the greatest number of troubles for a day's work in order to restore service to as many subscribers as possible. "Get it working" has been a familiar telephone slogan for years.

Reoccurring conditions of this kind, especially in a new plant, soon result in a general bad condition, unless prompt measures are taken to avoid it. Slack guys result in broken poles, which may be the beginning of a number of broken poles, with their attendant troubles; slack wires result in broken ties and broken wires; loose fixtures and fittings are frequently reported as causes of troubles; all of these things eventually necessitating a trip to restore service that need not have been interrupted. Likewise there are many items of station complaint familiar to us which forethought, observation, and initiative will forestall.

Wire Chief Has Responsibility

Maintenance statistics over a period of years have proven that the repairman or wire chief has one of the most important responsibilities for service in the organization. For example, it was found that so-called repeated complaints had less of the time element and more of the mechanical than had previously been considered. That is to say, ordinary wear on equipment and apparatus, due to use, would not be sufficient to cause its failure in the relatively brief time between complaints, but that failure of the particular unit was eminent at the time of a previous visit and might easily have been observed by the mechanic had the importance of thinking about it been previously pointed out to him.

It had been customary to consider that a complaint received within three months of a former complaint would be called a repeater. Our check indicated that complaints might be considered as repeaters after six months or a year because of conditions existing which had been underestimated or overlooked on a previous trip. It was found, too, and quite naturally, that repeaters have something of a ratio to usage so that two or three cases per year on a business telephone did not necessarily constitute a repeater, but that one case per year on a residence telephone might be so considered. And why not? Assume a subscriber's residence served directly from a cable terminal; standard drop wiring, standard station wiring, a desk telephone properly located and with respect to collision and abuse; what is there about it to get out of order due to usage or wear; what is there on it that won't last a year? Nothing—except possibly the cords. Even those will stand up for long periods under the twisting and tying to which they are frequently subjected in service.

I believe it is fair to assume that nearly every wire chief has active subscriber cards in his files on which he has no trouble recorded for at least two years, possibly five years, or even longer.

Preventive Trouble Maintenance

These observations, taken chiefly from exchange trouble report records, suggested a survey which was undertaken with the idea of determining to what extent preventive trouble maintenance could be expected to reduce service interruptions. Accordingly, work was begun in the city area because of the extensive cable plant and the corresponding service hazard in time of failure. The advent of the gas pressure method of testing cables greatly facilitated the initial program. The results achieved were sufficiently encouraging to warrant a broad expansion of the plan.

The suburban area with its relative preponderance of open wire lines, presented a different set of conditions—the increased number of pole line miles per man; road conditions during bad weather and various other things common to suburban exchange maintenance that require consideration in arranging a preventive maintenance plan.

It was not considered necessary or advisable to increase the maintenance force

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for this work. It was also apparent that should extra help be provided, a great deal of the wire chief's time would be required to assist in planning and advising as to road information, reports, data, etc. Consequently, it was estimated that little more time would be required for him to do the whole job than to assist in this manner. In either case he is responsible for the final result. The first consideration was to insure a complete inspection of the exchange on a part-time basis. In this the wire chief, to a large extent, solved the problem for himself. A closer analysis of routine troubles and exchange work enabled him to segregate the less important items of work and so localize his efforts as to effect a considerable saving in time. Few cases of trouble require less than fifteen minutes of clearing time; if four of those are mouthpiece, number cards or any of the multitude of little troubles which can be held over for a day, an hour has been made available in which to work on inspection. Accordingly, a patrol and inspection plan was developed by which it is expected to cover each exchange district once a year.

Schedule of Routine Inspection

The plan provides for a routine inspection of all plant by the wire chief forces. This inspection and the resulting repair work is a part of the daily routine.

The schedule provides that patrol of pole lines within the corporation limits shall be made between November 1st and April 1st, which is the period in this section when rural roads are most difficult of travel.

Patrol of pole lines, including substations outside the corporation limits, is made between April 1st and November 1st.

All defective or non-standard conditions are repaired or made standard at the time of inspection except those of a character requiring additional help in which case a regular work order is issued covering the work.

Station inspections within the corporation limits are not necessarily made at the time of line patrol, but are considered separately as local requirements indicate.

Topographical maps are furnished each wire chief showing the exchange boundary lines and all of the pole lines therein; their route numbers, and the number of junctions and branch line poles.

A pole line card record is kept of each pole line route after the manner of a subscriber line record, the route number shown on the topographical map appearing in place of the subscriber's line number. On this record is shown the inspection or patrol dates, pole numbers inspected and the work done, except that drop and station inspection work are shown as inspection trouble on the regular subscriber's line card.

Three inspection reports are made; one for trimming, involving right-of-way trouble or large trimming jobs which cannot be done at the time of inspection; one for each station inspected, and the third a weekly report summarizing the line patrol work.

All of these reports are forwarded weekly for compilation and analysis.

Reports Vindicate Operator

You may well suppose that the analysis of these reports do not indicate that the operator is remiss nearly so often as she has been accused. On the contrary, it emphasizes clearly that there are many items incident to good service which have no direct interest for the subscriber, yet they mean much in the quality of service he receives. More than this, it indicates a new sense of responsibility to the plant man and that he is discharging it in a typical manner.

This is as it should be. We have assumed the responsibility for service which will meet the ever-changing demands of industry and trade. Telephone progress has been industrial progress. We are constantly striving to anticipate the demands of service. This has always been so in the engineering branches of the industry, particularly along development and construction lines.

Maintenance, financially, has often been classified as one of the big leaks which no amount of sand bags has been able to stop, and yet maintenance has been a considerable factor of progress.

In the past few years, particularly, improved maintenance practices have provided many additional subscriber hours of uninterrupted service. It is recognized that improved materials and equipment have contributed a great deal to this result. Nevertheless, the improvement in service and the constant endeavor to further improve it, is peculiarly the plant man's problem because of his nearness to it. By his painstaking effort in this direction he has provided some valuable and interesting methods for service improvement and the most valuable of them have been along preventive lines.

Service Interruptions Fewer

In the light of present experience it is unquestionably the right line. Service interruptions become fewer and fewer because day by day more of their causes are being removed. Prevention is admittedly superior to cure; and yet this does not sum up our service responsibilities.

Plant people are coming to a fuller realization of how definitely their responsibilities for service are associated with community life. In many instances, the plant man is looked upon as the company's representative in his community. It is of the utmost importance that he reflect the company spirit in a true sense.

By giving freely to civic enterprises, of the time and means at his disposal; by contributing the benefits of his training in safety and first-aid and by the numerous opportunities for service which lie outside of physical plant problems, the plant man can contribute a great deal to the fulfillment of community life. Our own success depends upon the success of those we serve. In contributing to them we are reaping the reward of satisfaction which comes of good service and our efforts in this direction are much more likely to be recognized and appreciated and our public relations correspondingly more cordial.

This is the plant man's responsibility for service.

LOEHR ATTAINED 50 YEARS OF SERVICE BEFORE HIS DEATH

One of that generation of men who have been connected with the telephone industry since its infancy passed from the scene in the recent death of Frederick W. Loehr.

Mr. Loehr, who lived in Chicago, was the dean of the 27,000 telephone makers in that city and the first man in his industry to attain half a century of service. About three years ago he retired, having seen exactly 51 years and two months of active service.

Born in New York City in 1858, he entered the communication industry with the Western Union. In 1879, the shops of that company were bought by the Western Electric Manufacturing company to continue to manufacture telegraph instruments and to manufacture telephones. In that way Mr. Loehr became connected with the making of telephones only a few years after Alexander Graham Bell had invented the instrument.

Shortly afterwards, Mr. Loehr was transferred to Chicago and became part of the small shop force then maintained there by the Western Electric company. Until his retirement he remained an active member of the organization, when it had grown into the largest telephone workshop in the world.

Among the thousands of experts engaged in that work, he had a reputation for fine workmanship. He is credited with introducing certain manufacturing methods still in use.

REPLACES 26 YEAR OLD BOARD

The Oakdale Free Exchange Telephone association of Oakdale, Ill., has just replaced their 26 year old Stromberg-Carlson magneto switchboard with a new No. 105 Stromberg-Carlson magneto switchboard.

MR. P. KERR HIGGINS SAILS FOR EUROPE

P. Kerr Higgins, president and general manager, the Scotia Telephone company, St. Louis, Mo., sailed for Europe from Quebec, Canada, June 27. Mr. Higgins will visit several European countries, including Great Britain, Norway, and Sweden.

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Thousands upon thousands of these flashlights have already been purchased on special orders by many of the largest railroads and industrial concerns in the country, which have selected Bond Industrialites because of their proven superiority. This light is exceptionally well built, easily operated and will give maximum service to the user.

It has a tough fibre case, which can be subjected to the roughest usage without danger of being marred, scratched, dented or having the efficiency of the light impaired in any way whatsoever. A strong metal clip makes it possible to attach the Industrialite to the belt, pocket or other convenient places. A hole drilled in the clip is provided so that the light may be hung from a nail or peg. It is equipped with standard batteries and bulbs, which are procurable anywhere.

BOND ELECTRIC CORPORATION

JERSEY CITY, N. J.

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The Toll Board's Silent Partner

LITTLE fuss is ever made over the Calculagraph. It is such a small, compact, trusted and tried instrument that it's taken pretty much for granted by 99% of the world's telephone companies. But do not overlook its importance. Without the Calculagraph on the toll board, records of toll charges would indeed be in a sorry plight.

The Calculagraph stamps on the toll ticket the beginning of each call together with the time elapsing during each call, down to the quarter of a minute, for any number of calls—producing a permanent and accurate record of each.

Prices and Information on Request.

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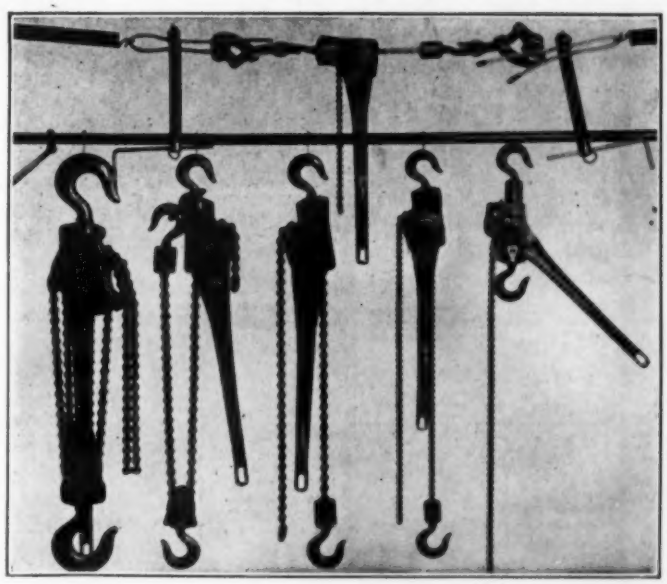
CALCULAGRAPH

THE ELAPSED TIME RECORDER

Coffing Hoist and Guy Clamp

The Lineman's Friends

FAMILY GROUP



Model Z 6 Ton Weight 65 lbs.	Model F. S. 3 Ton Weight 36 lbs.	Model F. 1½ Ton Weight 25 lbs.	Model A. ¾ Ton Weight 13 lbs.	Model A Reversed

Hoists can be used either end up or in any position.
A truly one-man tool, light, fast, powerful, simple, durable.
Models A and F particularly adapted to utility work, pulling guys, messenger wires, underground cables, poles, lifting transformers, loading heavy supplies, booming poles. Also have a pole jack for pulling and straightening poles. Pole clamp for changing top cross arms on corners and in pole lines. Will send on 30 days' trial.

COFFING HOIST COMPANY

317 East Vanbren Street DANVILLE, ILLINOIS

THE TECHNICAL CLEARING HOUSE

B. C. BURDEN, Editor

Pole Stepping

Q.—What is the standard method of stepping terminal poles?

A.—Terminal poles should be stepped

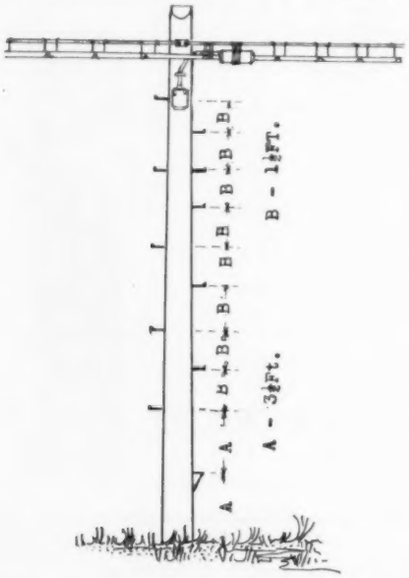


Fig. 1—Method of stepping terminal poles.

as shown in Figure 1.

Insulation Resistance Testing

Q.—What insulation standards are usually specified for uncovered condensers which are used in common battery subset?

A.—Larger companies usually require re-used condensers having an insulation resistance of 1 megohm. The insulation resistance of condensers can readily be determined by means of the testing arrangement shown in Figure 2, in those offices not already equipped with a high resistance voltmeter. Voltmeters of a low resistance type are not sufficiently sensitive to give readable reflections on high resistance leaks.

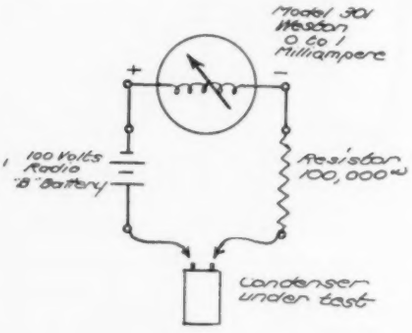


Fig. 2—Insulation resistance measurements.

Meter Reading Milliamperes	*Insulation Resistance in Ohms*
.001	0
.0009	11,111
.0008	25,000
.0007	42,857
.0006	66,666
.0005	100,000
.0004	150,000
.0003	233,333
.0002	400,000
.0001	900,000
.00008	1,150,000
.00004	2,400,000
.00002	4,900,000

Pyrex Insulators

Q.—I notice that on some of the principal toll lines some of the insulators are clear glass rather than the usual green variety. What is the purpose of this type insulator?

A.—The insulators referred to are made of pyrex type of glass and are used on carrier frequency circuits which carry three channel carrier systems. These insulators have lower dialectric losses and provide better insulation during wet weather. These two qualities are necessary for successful operation of carrier systems over long distances. For information on carrier systems, readers are referred to Mr. Domerque's recent article on this subject in TELEPHONE ENGINEER.

Station Installation

Q.—How high above the floor should a wall telephone be placed?

A.—Unless the subscriber expresses some preference, the wall telephone should be located so that the transmitter is approximately 55 inches above the floor.

Dry Cell Testing

Q.—We test dry cells in local battery telephones by reading the short circuit current with a low resistance pocket ammeter. Is this a good method, and if not, what method would you recommend?

A.—No, the ammeter method is decidedly not good practice as it fails in many cases to give an accurate indication of the capacity of the cells being tested. The method recommended by the Bureau of Standards and battery manufacturers consists of discharging the cell to be tested through 6.6 ohms for one minute and then reading the voltage across the resistance at the end of the one-minute period. Telephone cells are considered to have reached the end of their useful life or "cut of point" as it is called when a reading of .93 or less volts is obtained. A battery tester suitable for making the above test can be made up using a Weston 506 type voltmeter connected as shown in Figure 3.

Ground Wires on Rural and Toll Poles

Q.—Explain the theory back of the practice of placing ground wires on rural and toll line poles.

A.—The practice referred to consists

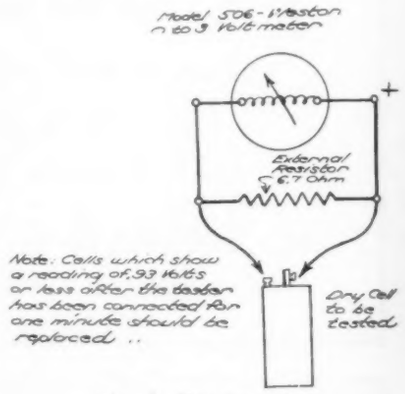


Fig. 3—Battery tester.

of placing a No. 9 galvanized iron wire from the bottom to the top of every tenth pole in the lead, at the time the pole is reset. The wire is stapled at the base of the pole. This arrangement is based on the theory that a ground wire extended to the top of the pole at frequent intervals along the line will tend to reduce the potential of the surrounding air, thus reducing the possibility of a lightning discharge to ground. Some of the larger companies have discontinued this practice, feeling that it is not worthwhile.

Cable Color Code

Q.—What is the significance of the color code used on the insulation of switchboard and building cables of the coded type?

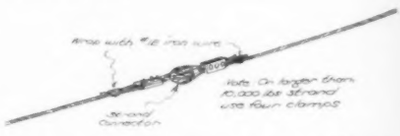


Fig. 4—Method of splicing cable supporting strand.

A.—The color code used on coded cable permits the identification of pairs at the opposite ends of the cable without the necessity of buzzing out. In order that a uniform method be used it is always customary to terminate pairs of a given color on the same relative terminal posi-

LOW COST POWER for magneto boards

Fansteel Combination Power Unit, Type CAB-4, operates from A.C. light socket, supplying dependable D.C. power for 1, 2 and 3 position boards. Consumes only a few watts. Storage battery reserve will operate boards for days in case of A.C. line failure. Ask your regular supply house or write for bulletin and prices.

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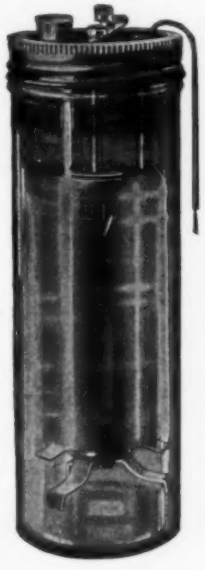

They will not deteriorate in stock. When set up you will find they are excellent for service of the highest degree.

They not only last longer, but the quantity of available power remaining is clearly visible at all times.

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tion with respect to the rest of the pairs in the cable. This standard method is as follows:

Color Code	*Pair No.*
Blue	1
Orange	2
Green	3
Brown	4
Slate	5
Blue white	6
Blue orange	7
Blue green	8
Blue brown	9
Blue slate	10
Orange white	11
Orange green	12
Orange brown	13
Orange slate	14
Green white	15
Green brown	16
Green slate	17
Brown white	18
Brown slate	19
Slate white	20

It will be noted that the coding is based on the five base colors and systematic combinations of these colors. This makes it very easy to remember the coding. By means of additional color combinations the code is extended up to 100 pairs. Every telephone man who deals with central office equipment maintenance should know the color code.

Pipe Pushers

Q.—How successful are pipe pushers and what is the method used in operating such equipment?

A.—Pipe pushers of good design can be used to push pipe of 3-inch or smaller diameter for distances of as much as 150 feet. Pipe can be pushed most successfully in clay or loam soils. It is practically impossible to push pipe in sandy soil.

A pipe pusher is operated by placing it in a trench several feet wide and about 5 to 8 feet in length. A trench at right angles to the first trench is used to hold a heavy plank against which the pipe pushed can bear. The pipe to be pushed is placed in the pusher and by use of a long handle operating a set of grips and a rack arrangement the pipe can be pushed through the soil to the desired location. The end of the pipe is equipped with a reducer and pipe plug.

If the push is not made in filled soil the pipe can be pushed with fair accuracy. In filled soil there is always the possibility that the pipe will strike an obstruction of some sort and be deflected away from its objective.

Strand Splicing

Q.—What is the correct method of splicing cable supporting strands?

A.—Best present-day practice consists in using a metal strain insulator and dead ending as shown in Figure 4.

Cable Crystallization

Q.—What can be done to prevent cable sheath from crystallizing at bridge crossing?

A.—Crystallization of cable sheath where supported to bridges is due to the vibration of the bridge being transmitted to the sheath via metal rings. This trouble can be eliminated by using old style marlin hangers at such places.

Boiling Out Compound

Q.—Should beeswax or paraffin be used for boiling out silk and cotton switchboard cable?

A.—Best practice consists in using a compound composed of equal parts of beeswax and paraffin.

Fire!—And a Record Installation

[Oak Grove Telephone Company Makes Record Installation After Fire Destroys Exchange]

By H. M. STEWART
Rep., Kellogg Switchboard & Supply Co.

Fire! The middle of the night—bells ringing and fire apparatus rushing to the scene—volunteers doing their utmost to check the flames. Yet, not until the entire central office and all the equipment of the Oak Grove Telephone company had been destroyed, was the fire brought under control. The billings for the month were the only records saved and that was because the operator on duty rushed back into the flaming building and gathered them at the risk of her life. And Oak Grove, a growing center of 1500 people in northeast Louisiana, was left without telephone communication—isolated from the outside world.

The same night A. C. Monroe, owner of the Oak Grove Telephone company, sent a wire to the Kellogg Switchboard & Supply company at Chicago. Kellogg, in turn, immediately wired J. C. Head, their local representative at DeQueen, Ark. Mr. Head left at once for Oak Grove and arrived the day following the fire.

Immediately upon his arrival, he and Mr. Monroe held a consultation to plan the reconstruction work. Less than two hours later a location for the new office had been chosen and complete plans for new equipment had been prepared. Meanwhile, telephone men were busy rigging wires and making new connections so that at three o'clock that same day long distance service had been established and Oak Grove once again had telephone connections with outside points.

The order for new equipment was sent to the Kellogg company who had already signified their intention of co-operating with Messrs. Monroe and Head to the best of its ability in building the equipment in record time. Exactly four days after the order was placed, complete shipment was made—a record that speaks for itself.

The new board and equipment were installed and connected by H. B. James, efficient combination man of the Oak Grove company, and S. J. Daigle of Monroe, La.

They worked so rapidly and well that all service was restored to the city of Oak Grove 16 days after the old equipment had been entirely demolished.

Needless to say, in the rehabilitation of this property several outstanding records were made and the results accomplished are indeed a tribute to everyone connected with the work. Messrs. Monroe and Head especially are to be commended—Monroe because he fully appreciated the value his community placed upon telephone service and because he "came through" a heavy loss smilingly with the thought uppermost to restore communications as rapidly as possible; Mr. Head because he and the company he represented did everything possible to assist in rebuilding the system without loss of time.

The efficiency of these men, their loyalty to the telephone company and the people it served, and the tremendous task they accomplished in re-establishing communication as quickly as possible, is a praiseworthy achievement that is enough to warm the heart of every telephone man.

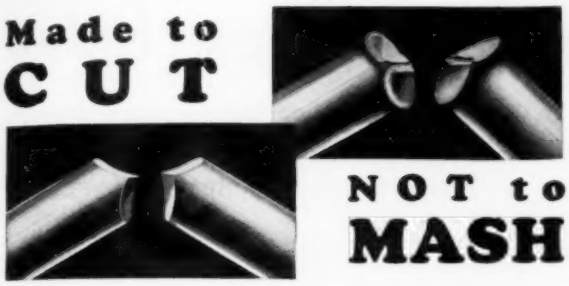
Mr. Monroe purchased the company eighteen years ago when he served only sixty-five patrons. Serving more than 200 stations, the present Kellogg Magneto switchboard has a 400 line capacity, and is sufficient to care for the future growth of this progressive city for some years to come. Lamp supervision, the most efficient type of keyshelf control over disconnect signals, is provided on the new board, making it the most modern equipment for magneto exchanges available on the market today.

BELLIONS ARE VICTIMS OF RECKLESS DRIVING

M. A. Bellion of Chicago, manager of the supply department, Kellogg Switchboard & Supply company, and Mrs. Bellion were victims of reckless driving in an automobile collision near Park Ridge, Ill., June 7.

The car in which they were riding was sideswiped by an oncoming car and overturned into a ditch. Mrs. Bellion suffered a slight skull fracture and Mr. Bellion had two ribs fractured.

Made to CUT NOT to MASH



Enlarged photograph (left) of steel wire CUT with Vacuum Grip No. 58 and (right) MASHED with ordinary pliers.

IT'S easy to cut heavy wire with Vacuum Grip Lineman Pliers. A surprisingly small amount of pressure does the trick. Examine the ends of a piece of wire severed with No. 58 and you'll find them *cut clean.* Then repeat the operation with ordinary pliers and you'll note that the ends of the wire are *mashed—not cut!* Tough on the lineman's hands.

No matter how much a lineman works with heavy wire, his hands won't be sore if he uses No. 58. Those sharp, powerful cutting blades *stay* sharp—*and they stay in alignment, too!* A wonderful cutting tool, as any lineman who has used it will tell you.

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No. 58—8½" Popular size.
No. 56—6"
No. 57—7"
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No. 158—8½" Sleeve twisters in handles.

Special hardening and tempering processes applied to the cutting edges of Vacuum Grip Lineman Pliers give them toughness to withstand rough use for incredibly long periods. Purchasing agents who subject them to running tests soon learn that they outlast ordinary pliers *eight and ten to one!* In terms of dollars of cost per year they are by far the best buy on the market.

Write today for samples in the sizes most used by your men and let the pliers themselves prove our claims

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NOISELESS NON-PULSATING D-C from an A-C source

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•
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Not just another battery charger or rectifier, but a producer of pure, non-pulsating Direct Current from an A.C. supply. Operates without auxiliary equipment and can be used in place of batteries and motor generators. No moving parts, no hum, low impedence, close voltage regulation and instant response. Requires little or no maintenance. A.C. low voltage for ringing is optional. Where a "stand-by" is required, a Power Filter and a battery may be connected to float in parallel on line, the Power Filter carrying the load. Non-surging and has stabilizing effect on circuit. Reversal of polarity is not harmful. Write for bulletin today.

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Effect of Magnetic Interference on Relays

Relays Energized at High Ampere Turns Are Little Affected by Adjacent Relays According to This Article by W. Buhler, in Charge of Local Systems Development, Bell Laboratories, Who Says that Only at Low Ampere Turns Is There a Large Magnetic Interference Effect

A relay is operated by the magnetic pull between its armature and core. In an "R" type relay for example—indicated in outline in Fig. 1—current flowing through the winding on the core forms (for the direction of current shown) a north pole at the outer end of the core,

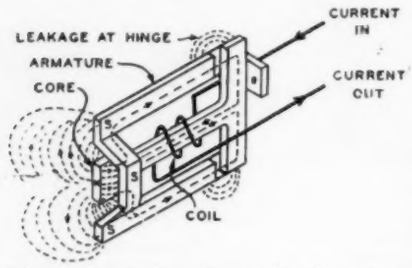

Fig. 1—Operation of a relay is caused by the pull between the magnetic poles which are formed on the front ends of the core and the armature.

and a south pole at the end of the armature opposite it. As a result a pull exists between core and armature which depends, among other things, on the number of turns of wire on the core and the amount of current flowing. The pull increases with increase of current till the core becomes magnetically saturated—beyond this point it is little affected by an increase of current. As the armature is attached to the core at the back end by a flat spring, which readily flexes, the magnetic pull moves the front end over, operating any contacts that may be attached to it.

Although most of the magnetic flux, which causes the pull, is concentrated in the air gap between the front ends of the core and armature, part of it spreads out and returns to the back end of the core over a longer path through the air. Any iron in the vicinity—due to its high permeability—would become a likely path for this stray flux to follow. Because of this the cores and armatures of nearby relays often serve to conduct stray flux as shown in Fig. 2.

In the situation shown here, the stray flux that spreads over to the left relay, from the energized relay on the right, exerts a pull on its armature that tends to hold it in the unoperated position. As a result more current will be required to operate the left relay than would be were the adjacent relay not energized. As a large number of relays are required in telephone offices, it is necessary to mount them as close together as possible to conserve floor space, but it has been found that, mounted in this way, their operation may be influenced by magnetic flux straying from adjacent relays or other apparatus.

To make this magnetic interference visibly evident, two similar "R" type relays were mounted side by side on one-inch centers. A glass plate covered with a thin layer of iron filings was then placed over them. When the relay on the right was energized to 350 ampere turns (product of number of turns on the core and the current flowing) and that on the left to only fifty, the iron filings aligned themselves as shown in Fig. 3. Here the flux lines from the core of the right relay extend to the armature of that on the left and exert an appreciable pull on it. The core of the left relay exerts a pull tending to operate its armature, but under the conditions shown, the pull is counteracted by the stray flux from the right hand relay.

When the current flowing through the left relay is increased so that it about equals that flowing through the right, the magnetic conditions are those indicated by Fig. 4. Under these conditions the two magnetic fields tend to neutralize each other. This indicates, and tests bear out the fact, that relays energized at high ampere turns are little affected by adjacent relays; that only at low ampere turns is there a large magnetic interference effect.

Even at low ampere turns, however, it is ordinarily necessary to consider interference only from adjacent relays, those mounted either directly at one side, above, or below. With the type of relay shown in the illustration it is the relay to the right that has the most effect.

This interference affects the sensitiveness of the relay, and—depending upon its mechanical structure—may cause it to be slower or faster to operate or release, or to remain operated indefinitely. In some cases, it is necessary to increase the circuit operating current to insure operation. On relays requiring low operating current, this increase may reach forty or fifty per cent.

In taking critical time measurements in the laboratory to determine whether under the circuit conditions a relay will operate or release in the time allotted to it, the effect of adjacent apparatus must be taken into consideration. To accomplish this any neighboring relays that may be operated under the actual circuit conditions are energized when the relay's operate or release characteristics are determined. If this is not done, the measurements may show that the relay time is satisfactory, whereas under actual circuit conditions a circuit failure may result due to the change in operating or releasing times caused by magnetic interference.

It has been found by laboratory tests that this interference may be overcome in several ways. An insulating effect may be obtained by using magnetic materials to form a short circuit path for the magnetic flux. Apparatus is sometimes mounted under covers of magnetic ma-

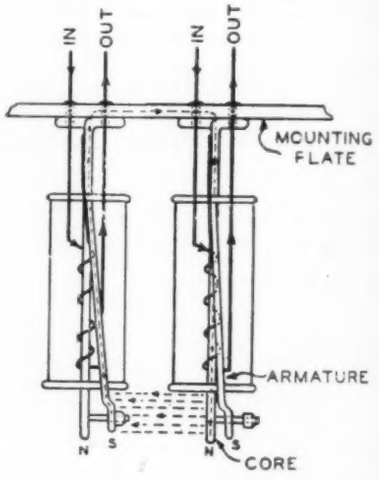

Fig. 2—Magnetic flux from the core of an energized relay will sometimes extend over to an adjacent relay and influence its operation.

terial such as iron or permalloy which produce a shielding effect by providing an easy return path for the lines of force. Such covers act as barriers to the magnetic flux. In some cases a whole strip of relays is protected from the relays below by mounting them as the top relays of a unit, and by placing an iron plate under them.

Some relays of the slow acting type have in the past been furnished with removable individual brass covers which, since brass is non-magnetic, afford no protection against magnetic interference. Tests made in the laboratory show that when relays are subjected to magnetic interference they may fail to release under some conditions. It was found, however, that by replacing the brass covers with iron ones, the trouble was eliminated. Wherever investigation discloses that the magnetic interference is a factor in preventing the proper functioning

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It costs you nothing for full particulars and it will be our pleasure to furnish them.

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THE NEW ANTWERP TELEPHONE AND ELECTRICAL WORKS, Antwerp
AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Liverpool
THE AUTOMATIC ELECTRIC COMPANY, LIMITED, Chicago
ALTON BATTERY COMPANY, Alton, Eng.

of a relay, it is usually specified that the relay be equipped with an iron cover which, however, somewhat reduces its efficiency. A polarized relay, recently developed, is equipped with a cover of magnetic material which is used as the return pole piece. This cover tends to shield the relay from outside magnetic forces. The use of an iron cover on some relays is unsatisfactory because of the loss of capability that results.

It is not always desirable, however, to equip relays with covers of magnetic material, and consequently other means have been resorted to. As the magnetic field extends outward, it becomes weaker; fewer lines of force exist to cause a magnetic pull. It is possible, therefore, to reduce interference by mounting the apparatus farther apart. This is indicated by Fig. 5 which should be contrasted with Fig. 2. The 206 type polarized relay is a case in point. It has no protection other than a brass dust cover, and due to its mechanical structure and symmetrical magnetic circuit, and the fact that it operates on low ampere turns, it is extremely sensitive to magnetic interference. Although this relay will mount mechanically on 1¾" centers, it should never be mounted closer than 3½", either vertically or horizontally, from other relays or magnetic apparatus without considering interference.

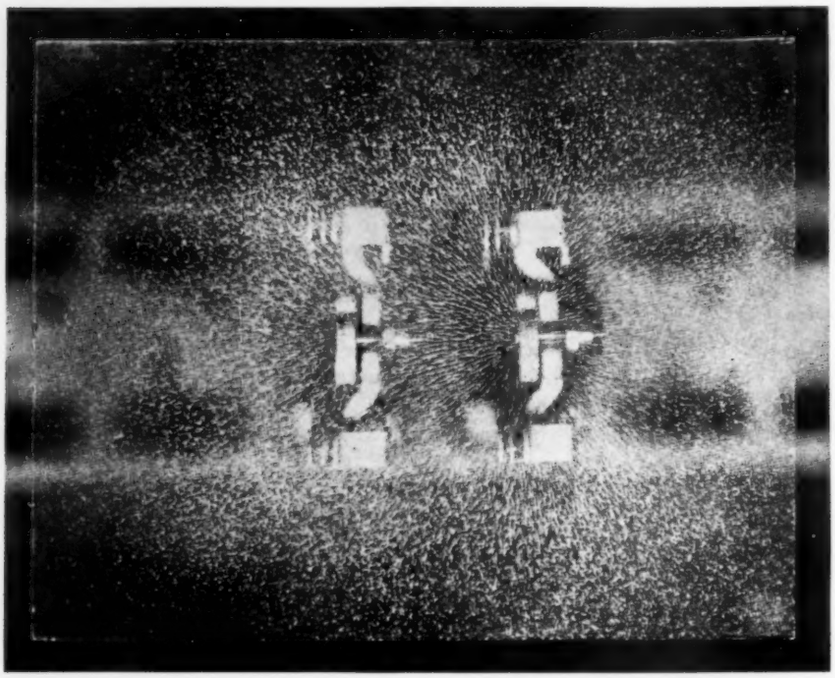

Fig. 3

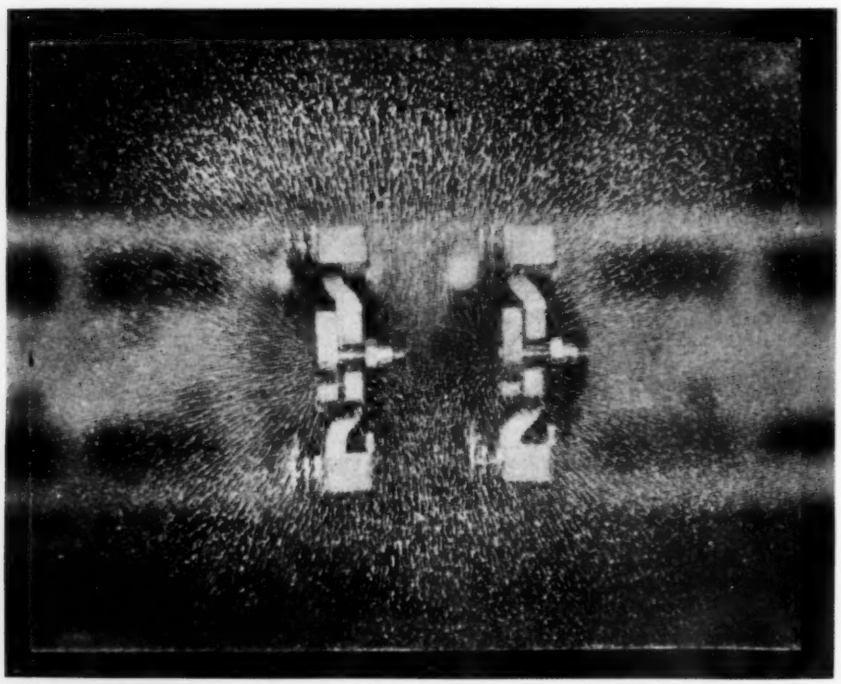

Fig. 4—When both relays are equally energized the magnetic forces counteract each other, as indicated by the lines of force traced by the iron filings.

Relays such as the "R" type usually mount under a tin-plated steel cover common to 10 or 20 relays. In circuits using large numbers of them, such as the sender and decoder circuits, they are mounted in large cabinets, all under one cover. Preliminary equipment layouts are usually made ignoring magnetic interference unless it is definitely known from previous studies that a particular relay or relays must be considered. Later, however, a study of each layout is made to insure that all have sufficient margin to overcome interference from adjacent relays which may be energized simultaneously. It is necessary in some cases to revise these layouts after it has been found by laboratory tests or analysis that circuit failures may result. This is done by moving the affected relay to some other location, where the adjacent apparatus will not be energized at the time this particular relay functions. When designing new "R" type relays, the maximum effect of magnetic interference is compensated for by allowing certain margins between the minimum current which may flow through the relay in the circuit and the current to which it is adjusted for that circuit.

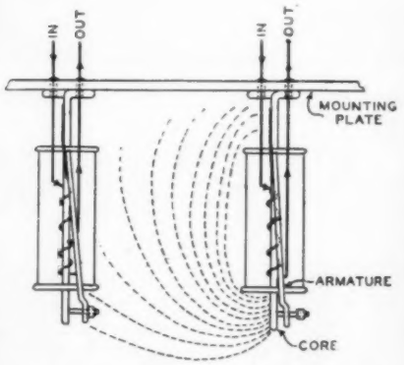

Fig. 5—The effect of magnetic interference may be greatly reduced by increasing the distance between adjacent relays.

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Magnetic Telephones, all makes, also parts for all makes. Also Leich late type Ringing interrupter, battery charging complete. Make offer in small or large quantities.

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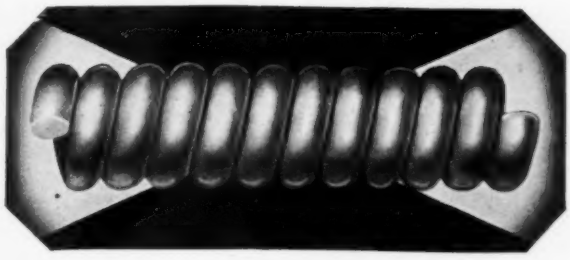

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Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

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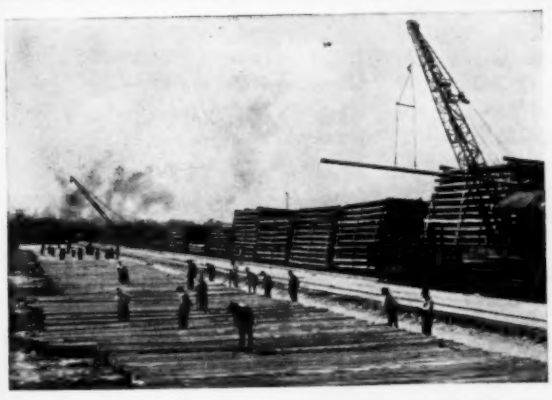

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A heavy sleet—high wind—a hurricane—there are times when you need quantities of poles quick! Ample stocks of National Lumber and Creosoting Company Poles are maintained at all times for just such emergencies. Southern Yellow Pine for Strength, Pressure Creosoted for Permanence. Whether or not it's a rush order, you will appreciate National Lumber and Creosoting Company quality and service.

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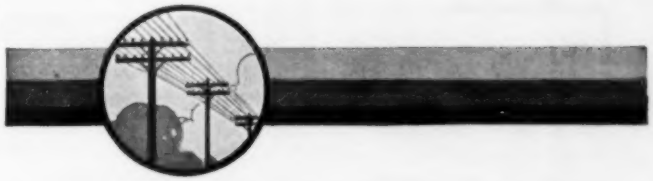

AN ORGANIZATION OF EXPERTS

IN the manufacture of any product, there are invariably certain things relating to design, to the quality and relative proportions of component materials, to the various processes of practical fabrication—which can be learned only by experience.

The manufacture of wires and cables is no exception. For telephone cables, for magnet wire, for power conductors—uniform conductivity, proper tensile strength and unfailing, durable insulation are of the highest importance.

For such products, experience is a prime requisite. For forty years this company has been in the business of manufacturing wires and cables—of every kind and for every purpose. Our employees are experts, trained to value quality above all else. As a result, the name Phillips has become a synonym for excellence, a guarantee of durability and quality. We will be glad to submit prices and specifications upon request.

We are manufacturers of—

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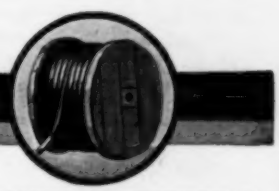


News From the Field

Associated Telephone and Telegraph company reports net earnings for 1930 amounted to $2,240,401 after all charges including depreciation and federal taxes. This is equal to $33.66 a share on the 66,554 shares of first preferred stock outstanding at the end of the year and to $14.40 on 115,000 shares of class A stock.

The assessed valuation of telephone companies in Utah for 1931 totals $7,298,588 as compared with $6,753,271 for 1930.

The new modern brick telephone exchange building in Starkville, Miss., was formally opened May 20th, at which time a new common battery system replaced the old magneto telephone system.

The Gulf States Telephone company will erect a six-story brick building in Tyler, Texas, at a cost of approximately $150,000. The new building will be 50x100 feet, and entirely fireproof.

Contracts have been let for the construction of two new exchange buildings in Fort Worth, Tex. The two buildings will cost approximately $100,000.

Expert technicians from the Western Electric company have been in Forrest City, Ark., rebuilding the exchange there which recently was damaged by fire to the extent of $4,000.

A new switchboard and distributing frame are being installed in the new telephone building recently constructed in Tishomingo, Okla., to serve telephone subscribers of that city. The move to the new building will require the placing of 1,000 feet of telephone cable.

Telephone surveys conducted recently show that the United States possesses 20,068,023 telephones, or 50 per cent of the world's total.

A telephone engineer says that the sequence switch in the panel system of telephony has twenty-four separate cams, eighteen positions to each cam and four springs on each cam, and that the number of different circuit combinations which can be set up on the switch with these springs totals 5,502,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000.

Work will begin soon on a new telephone exchange building in Sulphur, Okla. The structure will be a cream brick building and fireproof throughout.

The Stockbridge and Sherwood Telephone company of Stockbridge, Wis., is constructing an individual line to the Sunset Beach property on Lake Winnebago.

The Gulf States Telephone company plans to build a modern telephone exchange in Overton, Texas.

Extensions and betterments to the telephone system in the state of Virginia involving expenditures of $74,950 were authorized by the board of directors of the Chesapeake & Potomac Telephone company of Virginia at its recent monthly meeting at Richmond.

Construction has been started on the new Commonwealth Telephone company exchange building in Plymouth, Wis. The building, designed in Colonial style, will be a one-story and basement fireproof structure of brick. It is expected the structure will be completed by August 15.

The number of rural business telephones served by the Associated Telephone Utilities system increased approximately 10 per cent, exclusive of acquisitions, during the most recent six months' period for which figures are available. Officials of the system view this substantial increase in rural business telephones as possible indication of reviving commercial activity in rural areas.

Stockholders of the Cumberland Valley Telephone company have voted to change the name of the company to the United Telephone company of Pennsylvania. The Cumberland Valley company is a subsidiary of the United Companies, Abilene, Kans., and it is the policy of the latter concern to use the United name whenever possible.

Merger of three companies in Warren county, New Jersey, into the New Jersey Telephone company, has been approved by the State Board of Public Utility Commissioners. The three companies are the New Jersey Telephone company, Merchants & Farmers' Telephone & Telegraph company, and Stewartsville Telephone company.

The Southwestern Bell Telephone company is erecting a line from Anthony, Kans., to the airport outside of Anthony, to be used in connection with the new government weather station.

A new telephone switchboard has been installed at the telephone exchange at Guilford, Ind.

Aquisition of the Reedsburg Telephone company of Wisconsin and the Kearney Telephone company of Missouri has been announced by the Associated Telephone Utilities company.

The local office of the Ohio River Telephone company at Patriot, Ind., is being improved including the installation of new equipment.

There are 1,663,600 telephones in New England, served by 156 individual companies, according to the figures of May 1, 1931. Maine has 139,879; New Hampshire, 87,096; Massachusetts, 918,227; Vermont, 63,992; Rhode Island, 124,553, and Connecticut, 329,862.

Ninety-six telephone companies operate in Colorado, owning an aggregate total of 484,689 miles of telephone lines.

International Telephone and Telegraph company reports a net income of $2,832,302 for the quarter ended March 31, 1931. For the like period of 1930 the company reported net of $3,353,739.

The Illinois Commercial Telephone company is engaged in rebuilding lines between Toulon, Ill., and Elmira, Ill., as well as in the Jug Run vicinity, northeast of Toulon.

The St. Mary's Telephone company, St. Mary's, Ohio, will erect a new telephone office building which is expected to be ready for occupancy by October 1.

A telephone line between Summerfield, Kans., and Marysville, Kans., by way of Oketo, is in progress by the United Telephone company.

The line between Elliston and Garrison, Mont., is being re-routed due to the building of a new highway from Helena to Garrison.

A $10,000 repair and extension project of the Mountain States Telephone & Telegraph company for the city of Deer Lodge, Mont., started July 1.

A switchboard system that will facilitate the handling of fire alarms is being installed at the Central fire station of Racine, Wis.

The American people make an average of 83,520,000 calls a day, according to recent statistics. Since every telephone conversation involves two people, this means that 167,040,000 persons in the United States talk over the telephone every day. As this figure is considerably in excess of the total population of the country, it implies that many persons use the telephone more than once a day.

With Manufacturers and Jobbers

POWER FILTER UNIT GIVES D. C. CURRENT FROM A. C. LINE

Manufacturers of telephones, intercommunicating systems, public address systems, talking picture equipment and other sound producing apparatus, who have sought some economical method of supplying noiseless, non-pulsating D. C. power from the ordinary A. C. line, will be interested in the Power Filter Unit recently introduced by the Square D company, Detroit, Milwaukee, and Peru, Ind.

Square D Power Filter Unit—24 Volt; 2 Amperes for Telephone Operation

The Power Filter Unit is not to be confused with ordinary rectifiers for keeping operating batteries charged. While the Power Filter Unit can be used as the main source of D. C. power supply, with batteries as a "stand-by," keeping the batteries fully charged and greatly reducing the maintenance cost of the batteries, it should be kept in mind that the Power Filter Unit, without auxiliary equipment, can supply clear, pure D. C. from an A. C. supply.

The ability to supply a steady flow of D. C. from an A. C. supply system in relatively large capacities is of particular interest to elevator control manufacturers as difficulties inherent in A. C. operation such as less effective holding power of magnets are corrected by the use of D. C. power supplied by the Power Filter Unit.

Manufacturers of magnetic chucks for industrial work will also find that this unit will supply a pure D. C. current without the attendant nuisance of constant maintenance of motor generator sets and with considerable saving of space. Units for the operation of magnetic chucks are of sufficient compactness to be built into the base of the machine.

There are no moving parts in the Power Filter Unit—the action is entirely electrial; therefore there is little or no depreciation and maintenance costs are largely eliminated.

To the manufacturers of telephones and all types of sound and signaling equipment, the Power Filter Unit offers unique possibilities. It is noiseless, it has no hum and no moving parts, with tremendous condenser capacity, low impedance and the output voltage can be maintained within close limits. The Power Filter Unit does away with the necessity of storage batteries and dry cells. It permits A. C. low voltage for ringing, besides pure D. C. for talking. It also avoids the necessity for special circuits and relays for cutting out the A. C. power supply when the system is in operation.

Although but recently introduced by the Square D company the patented principle has been in use for the past several years.

Telephone, talking picture, intercommunicating and other sound and signal systems which have already been installed may also be equipped with the Power Filter Unit.

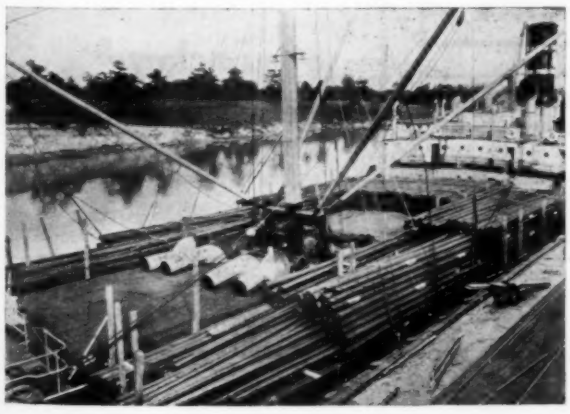
Descriptive literature covering the Square D Power Filter Unit is at the present time being published and requests for additional information will be supplied on request to the Power Filter Division, Square D company, 6060 Rivard St., Detroit, Mich.

LARGEST ORDER OF POLES SHIPPED FROM HOUSTON

What was reported to be the largest single order of poles ever forwarded by waters from Houston, Tex., was carried by the S. S. Ethan Allen when she pulled away from the Houston docks, recently, bound for San Francisco via the Panama Canal.

The poles, destined for telephone service in the territory of Hawaii, were produced, seasoned, gained, roofed, framed and treated to a final retention of 8 lbs. of Grade 1 creosote oil per cubic foot in the Houston plant of the National Lumber and Creosoting company.

The cargo will be trans-shipped at San Francisco for the remainder of the journey to Honolulu. Twenty-eight days are to be required for the entire trip from Houston to Honolulu.



Loading Poles on S. S. "Ethan Allen" Houston Ship Channel

STROMBERG-CARLSON OFFICIAL NAMED C. OF C. PRESIDENT

Wesley M. Angle, vice-president and secretary of the Stromberg-Carlson Telephone Manufacturing company, recently was installed president of the Rochester (N. Y.) Chamber of Commerce.

Wesley M. Angle, Vice-President and Secretary of Stromberg-Carlson Telephone Mfg. Co.

Mr. Angle has been active in Chamber work for a number of years, serving on numerous industrial committees. In addition to his positions with the Stromberg-Carlson company and the Chamber of Commerce, Mr. Angle is president of the Motley Milling company, treasurer of the Genesee Hospital and director of the Security Trust company.

He is also a member of the committee on Public Expenditures, which is a subcommittee of the New York State Economical Council.

ELDRIDGE RECOVERING FROM ACCIDENT

Frank L. Eldridge, head of the Frank L. Eldridge company, 11 S. LaSalle St., Chicago, is slowly recovering from injuries received June 2 when he fell down an elevator shaft in the new Sunflower hotel at Abilene, Kans., where he was a guest for the Kansas Telephone Association convention there.

Mr. Eldridge is at the Ravenswood Hospital in Chicago, where he will probably be confined until August. He has been the recipient of hundreds of cards and letters from his friends over the country, expressing their condolences, while a large number of his telephone associates and other friends residing in or near Chicago have called on him at the hospital in person.

NEW DESIGNING ENGINEER FOR JAMES R. KEARNEY

W. B. Duncan, who will be remembered from his past connections with the Dallas Power & Light company, the Southwestern Bell Telephone company, the Emerson Electric company and the Union Electric Light & Power company, is associated with the James R. Kearney corporation of St. Louis in the capacity of designing engineer.

GENERAL PHONE RATE QUIZ IN OKLAHOMA

A general telephone rate investigation has been ordered by the Oklahoma Corporation commission. As set forth in Cause No. 10,737, Order No. 5527, the commission orders an investigation of the rate structures of "all telephone companies in Oklahoma operated for hire, covering both toll and local exchange service."

Every telephone company in the state has been requested to prepare and present to the commission all information which they or the commission considers essential for use in connection with the investigation. Hearings will be assigned at such times and places as the commission may direct.

This order was issued June 18, and it will affect the following companies: Southwestern Bell Telephone, American Telephone & Telegraph of Indian Territory, American Telephone & Telegraph of New York, Western Electric, Oklahoma-Arkansas Telephone, and the Southwestern Associated Telephone.

The investigation has been ordered for the purpose of determining proper rates, joint rates, tolls, joint tolls, charges, rules, regulations, practices, classifications and schedules of all telephone companies.

No hearing dates have yet been set. The first phase of the investigation will involve the gathering of reports and information and making valuations of the properties of the telephone companies.

MRS. S. P. GRACE IS DEAD

Mrs. Elizabeth M. Grace, wife of Sergius P. Grace, vice-president of the Bell Telephone laboratories, died July 2 at her summer residence, Highland Hall, Rye, N. Y.

RECONSTRUCTED EQUIPMENT

Western Elec. No. 317 inside connection compacts equipped with No. 22 3-bar Gen., No. 38 1000 ohm 3-inch gong ringer, No. 250 Trans., No. 13 Ind. Coil and No. 122 Rec. @ $6.60 ea. Lots 10 or more @	$6.30
Western Elec. No. 317 compact same as above, but with 1,000-1,600 or 2,500 ohm ringer and 4-bar Gen. of well-known Mfg. @ $8.25—Lots 10 @	8.00
Western Elec. No. 317 compact, same as above, but with 5-bar Gen. @ $9.50 —lots of 10 @	9.25
Chicago Tel. Supply Co. 4-bar 1,600 ohm Bdg. compacts @	6.75
Am. Elec. No. 36 5-bar 1,000 or 1,600 ohm Bdg. compacts with Kellogg Trans. @	8.25
Kellogg No. 28 Cast head desk set with W. E. No. 240 3-bar 1,000 or 1,600 ohm external post signal set @	8.00
Kellogg desk set, same as above, but with Stromberg 4-bar 1,000 or 1,600 ohm inside cord connection signal set @	8.75
Cook No. 10 Arresters with heat coils and carbons, per bank 20 lines @	8.50
Leich Elec. Co., desk set with Stromberg 4-bar 1,000 or 1,600 ohm inside cord connection signal set @	8.75
Dean Elec. No. 240 4-bar 1,000 or 1,600 ohm Bdg. compacts with Kellogg Transmitter @	6.75
Kellogg No. 97 C. B. desk set with either 404 or No. 259 Steel bell box with Straight line ringer @ $7.00—Harmonic with 16-33-50 or 66 cycle ringer @	7.50

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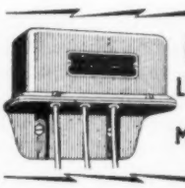

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COOK ELECTRIC CO.

No. 100	(per line)	$ .85
No. 60	(per line)	.50
No. 10	(per line)	.75
D-67523	(per line)	.50

WESTERN ELECTRIC CO.

No. 1168	(per line)	.60
No. 1169	(per line)	.60

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COLUMBUS, OHIO

PROTECT YOUR CABLE WITH EVERPROTECT
Permits underground installation without conduit. Protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.
Ask your nearest Jobber for complete details.
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Gray Label Telephone Batteries—*they last longer*
National Carbon Co., Inc., *General Offices:* New York, N. Y.
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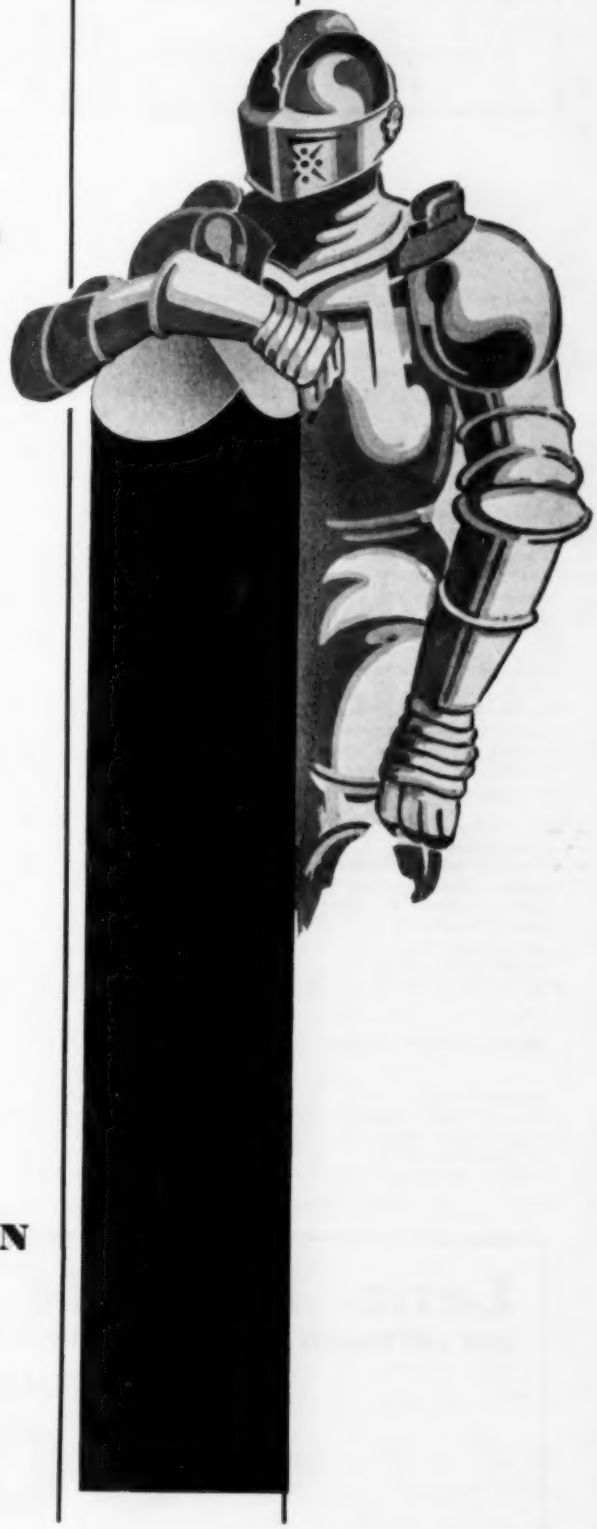
AS THE COST GOES DOWN

THE YEARS GO UP



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